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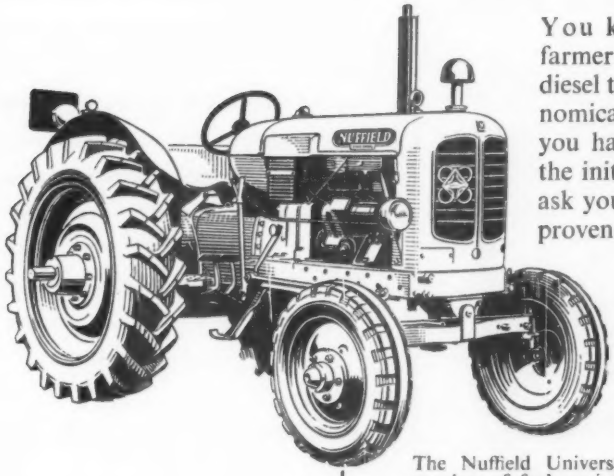

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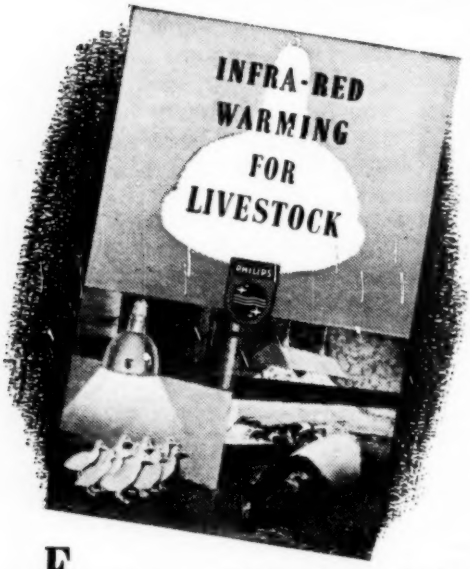

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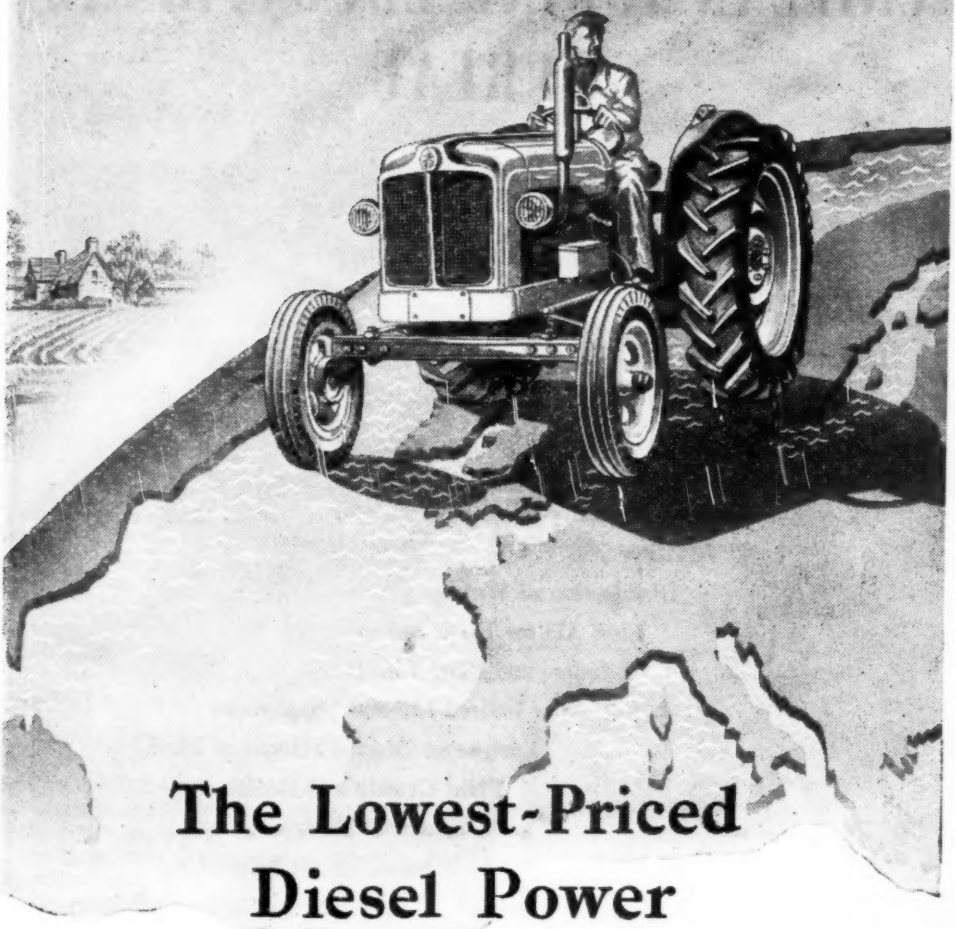

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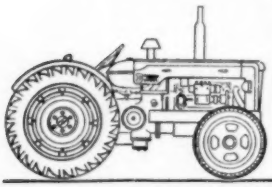

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ACCENT ON PRODUCTIVITY

ECONOMIC EFFICIENCY ON THE FARM

R. N. DIXEY, M.A.

Director, Institute of Agrarian Affairs, University of Oxford

In the third and final article in this series Mr. Dixey discusses the scarcity of land and labour in relation to the goal of greater output per acre.

THE essence of economics is that there is not enough to go round. People have to go through life balancing the advantages of having more of this against the drawbacks of having less of that, because they cannot have all they want of both. A farmer is no exception; he is continually faced with problems of choice. If he is to produce things to sell he must acquire the resources with which to produce them, and there is nearly always someone else who wants the same resources that he wants. So he has to decide which things to do without and how far to go in bidding up the prices of the things he means to have—and he must not go too far because there are limits to the prices at which he will be able to sell the products. It is on his judgment in this business of buying and selling that his living depends. Subject to one important proviso, the wider the margin between the value of his products and the value of the resources which he has used to produce them, the greater his economic efficiency. The proviso is that the margin be capable of being sustained over the years, because there is no efficiency in profits earned by running down fertility.

Resources and Returns The farmer's resources consist of such things as manpower, machine power, livestock, land and materials of all sorts. These are the things he has to acquire and combine in the right proportions to bring the best return, and he soon discovers (if he did not already know it) that his best return, his maximum profit, depends upon his obtaining high outputs from those resources that are the more expensive. It would not make for efficiency to put up an expensive glasshouse and then use it for growing maincrop potatoes.

When economic efficiency is in question, therefore, it is important not only to measure output but to watch the changing values of the inputs that contribute to it, so as to know which of them from time to time, being the more expensive, have the more significant impact on efficiency.

In a free-market economy it is the scarce resources that would be expensive while those that were abundant would be cheap. In such conditions, efficiency would be denoted by a high output from whichever resources were scarce and therefore expensive. The difficulty arises, however, that values are not left to the free play of the market, with a result that scarcity

and expensiveness do not always go together, and some resources that are in short supply are sometimes relatively cheap. This comes about because society has a habit of imposing controls or restraints. Some, such as tariffs, taxes, control of wages or credit may be imposed directly by law; others, such for example as the reluctance of a landlord to rack-rent, may be prescribed by custom or social pressure of one kind or another. But whatever form these interferences with competitive values may take, their effect is a lack of correspondence at any given time or place between the value assigned by society to any particular resource and its scarcity. It may be decided as a matter of policy that it would be unfair to allow certain scarce resources to get into the hands of people who could outbid their poorer, though otherwise deserving, neighbours. Society may therefore put values upon those various resources that may be very different from the values put upon them by this, that or the other business man.

This easily leads to conflicting interests. It is in the best interest of the nation that its scarce resources should be used as productively as possible, but for the farmer, as a business man carrying his own risks, it is the expensive resources that matter most, whether they are scarce or not. Economic efficiency on the farm depends, therefore, on the relative values of the resources the farmer needs, and so long as society keeps on altering the prices, or allowing restraints to be imposed by convention, it has only itself to blame if the efficiency of a farmer, as measured by himself, does not coincide with his efficiency as seen by the nation at large. If the nation is not satisfied to have it so, it must arrange values in such a way as to steer the farmer's inclination into the channel where his view and the national view of economic efficiency will coincide—where the price of a resource will be an indication of its scarcity.

Scarcity in Land and Labour As things stand today, many of the country's agricultural resources are scarce, but some are scarcer than others—among them, land. Not only is land very scarce, but its scarcity is the more significant because so little can be done about it. Even when all the land due for reclamation has been brought into use, it can never amount to a very high proportion of the nation's total acreage, nor contribute greatly to the nation's total production. It would be expected, therefore, that if prices were freely competitive, the value of land would be very high; and in fact, so far as there is a free market in land, this expectation is borne out by the evidence. If it be accepted that land offered with vacant possession is sold in what to all intents and purposes is a free market, recent figures show an average sale value of nearly £95 an acre in 1949–51, compared with a little more than £31 an acre in 1937–39(1). In other words, the free-market value of land is about three times as great as it was before the war.

Labour is another of the farmer's scarce resources, though it is not necessarily as scarce as land, because in the last resort the agricultural labour force could be expanded. Nevertheless, there has been a great rise in labour costs in recent years.

Obviously there is no one single resource in farming which can be claimed to be so much scarcer or more expensive than all the others that the nation can be satisfied to measure the efficiency of farms against that resource alone —not even land. Suppose, for example, it were said that because land was so scarce the efficiency of farmers must be measured by their output per acre, and by that alone, the position might arise in which the nation would

blindly divert all its energies and resources, or as many of them as possible, to maximum production from the land. Manufacturing industries would be starved of manpower, capital, raw materials, and so on. This would be a mistake, because there must be a point somewhere, even in this country—or especially in this country—beyond which it would be uneconomic to push agricultural production. There must come a time when the extra capital, and perhaps labour, used in home agriculture in such circumstances would yield less food than they would if they were used to produce goods for export to be exchanged for food in the world market.

Evidently, therefore, some kind of a balance has to be established between the values of the various resource shortages, and as the idea of leaving them to find their own level automatically has been dispensed with, it is necessary to arrive at a reasonable balance artificially. And while society as a whole is doing that on the basis of relative scarcity, the farmers arrive at their own balance on the basis of cost. They may not always argue it out with great deliberation, but they cannot help knowing which resources are costing them dear. They know where the shoe pinches.

In this connection the fact that has struck the majority of farmers most forcibly during the last few years has undoubtedly been the rising level of wages. If the index of agricultural wages in 1938 be taken as 100, the corresponding index in 1950 was 274—a very steep rise. It is true that the sale value of land, as mentioned above, also shows a threefold increase over a similar period, but that was the value of land sold with vacant possession, which has little direct significance for most farmers when they are looking at their costs. It is only a small minority of farmers who are farming land which they have bought with vacant possession. For all the others—and that is the great majority—the cost of the land they work is not its capital cost but its rental value, and that increased on average by no more than 25 per cent over the same period(2). With an index of rent of 125 and an index of wages of 274, there can be little doubt that the majority of farmers have felt the pressure of the cost of labour far more than the cost of land, and with it a strong economic inducement to work for high output per man rather than for high output per acre.

Output per Man and per Acre The economic forces which have been active in stimulating production have been more complicated than this statement would suggest. There has been a general increase of prices and other incentives such as requisite schemes, machinery pools, and the rest, which have led to increased production. Most of them have had the effect of increasing the output per acre, but many of them have improved the output per man. Fertilizers made available at relatively cheap rates meant that farmers used 2½ times as much (including lime) in 1950 as they did before the war. That must have been responsible for an enormous increase of production per acre. During the same period the use of machinery more than doubled, having a considerable effect on output per man, no doubt, as well as on output per acre. With so many currents and cross-currents, it is not always easy to trace their effects exactly, but this does not invalidate the claim that output per man has been rising faster than output per acre.

The figures overleaf, taken from a recent paper by H. T. Williams of the Ministry of Agriculture, and reproduced by permission of the author, lend some support to the point(3).

	At 1945–46 prices		At 1951–52 prices	
	Net Output	Productivity per Man-hour	Net Output	Productivity per Man-hour
1949–50	122	123	133	134
1950–51	121	125	135	139
1951–52	130	138	149	159

Indices (1937–39 = 100)

The comparisons were made with the prices held constant at levels prevailing in two periods, the years 1945–46 and 1951–52, and it is seen in each instance that the index of productivity per man-hour was higher than the corresponding index of net output. Thus if the net output can be taken as a measure of the output per unit of land, and if the productivity per man-hour is a good measure of output per unit of labour, the figures tend to confirm the supposition that farmers as a whole have been responding to the fact that land is a less expensive resource than labour. In other words, the level of rents in relation to other costs has been such as to lead farmers to act as if land were a good deal less scarce than in fact it is. Seeing that land is the scarcest of all agricultural resources, it may be that the national interest would be better served if output per acre were made a more important goal in the farmer's eyes. If that be so, the nation has the remedy in its own hands.

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1. Changes in the Sale Value of Farm Real Estate in England and Wales 1937–39 to 1951. J. T. Ward. *Farm Economist*, 1953, 7, 145.
2. Agricultural Property. O. T. W. Price. *ibid*, 1953, 7, 137.
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HIGHER OUTPUT FROM GRASS

R. A. Hamilton, B.Sc.,B.Agr. Dip. Agric. (Cantab.)
Imperial Chemical Industries Ltd.

Evidence from recent surveys suggests that grass still provides little more than the summer maintenance requirement of Britain's dairy herds. Yet, given proper management, it is capable of sustaining a high rate of milk production throughout the grazing season without supplementary feeding.

SOME 60 per cent of the agricultural land of the United Kingdom is grassland, either in the form of leys or as permanent pasture, and it has been estimated recently that it provides about 55 per cent of the total energy requirement of all our cattle and sheep. But impressive as these figures may be, it must be admitted that grassland is probably the most neglected crop on the national farm. It is the purpose of this article to examine the ways of making better use of grass as a feedingstuff and present some examples of farms where this has been achieved.

Grass, as grazing, should form the basis of summer milk production, and yet during the summer of 1951 fully 2 lb. of concentrates were fed per gallon of milk on a large number of farms in England and Wales. In other words,

the practice on a fairly representative sample of farms was to allow grass, in the form of grazing, and other bulky foods to provide for only maintenance and the first gallon of milk. The Report on the Milk Investigation Scheme 1950–51,* from which the above figure was taken, shows also that on average over 3 lb. of concentrates were fed per gallon throughout that year. The comparable figure for the year 1951–52, reported in the Journal of the Milk Marketing Board,† was just under 3 lb. of concentrates per gallon of milk produced. These figures were derived from a carefully conducted survey of over 500 farms in England and Wales, and they suggest that, in general, grass provides little more than the maintenance requirements of Britain's dairy herd. There are, however, exceptions, as is shown by the following instances of milk production from grass on selected farms in various parts of the British Isles.

The first example I should like to take is a 105-acre farm in Co. Armagh, Northern Ireland, carrying an Ayrshire herd of 55 cows and their followers. Here, an average yearly herd yield of nearly 700 gallons per cow has been maintained solely on grazing, grass silage and hay. No other foods have been given to the cows since April 1951. All-the-year-round production is practised, because a daily output of 90 gallons is required for a milk round.

The second case is that of a small Friesian herd in the Sussex Weald, with an M.M.B. herd average for the year ended September 30, 1953, of 926 gallons from 22 cows and 939 gallons from 6 heifers. Last year, grazing began on April 5, and concentrate feeding ceased on April 14; no supplementary feeds of any kind were provided until kale feeding started on September 30. Concentrates were reintroduced on October 1. During this time, one cow gave over 600 gallons from grazing alone, eight cows yielded upwards of 500 gallons, and five others between 400 and 500 gallons. The highest yielder—a heifer in her first lactation—calved on March 8, 1953, and gave in all 624 gallons solely from grazing. Another heifer calved on December 14, 1952, and yielded 553 gallons from grazing (out of a total of 983 gallons in her first lactation), while a third cow, which had calved on October 23, 1952, gave 592 gallons from grazing only, out of 1,323 gallons produced in 305 days in her fourth lactation.

Yet a further instance of sustained milk production from grazing can be quoted from the records of a herd of 33 Ayrshire cows in south-west Scotland. Grazing began on April 23, 1953, and the cows had no trough food between April 30 and September 1. During that period milk production averaged 460 gallons per cow. One cow just exceeded 700 gallons, three yielded between 600 and 700 gallons, ten between 500 and 600 gallons and thirteen others produced at least 400 gallons from grass only. The case of the highest yielding cow deserves mention. Calving on April 13, 1953, she maintained an average daily yield of 60 lb. over the 79 days from April 30 to July 18 and, despite the absence of concentrates or other supplementary foods, she was still giving 50 lb. daily at the beginning of September.

Many other instances could be quoted where good-quality grass, without any supplementary feeding, has sustained daily yields of 60 lb. and seasonal production of between 400 and 600 gallons of milk. The above examples suffice, however, to show that good grass is a valuable feed for cows and that there is considerable scope for increasing the output from grassland on many farms in the United Kingdom.

* *Cost of Milk Production in England and Wales*, 1950–51. *National Investigations into the Economics of Milk Production.* Issued by the Milk Marketing Board in association with the Ministry of Agriculture.

† *Home Farmer*, 1953, **20**, 15.

HIGHER OUTPUT FROM GRASS

Efficient Utilization of Grass It is well known that crop yields can be increased considerably by the proper use of fertilizers. Grass is no exception to this; in fact, being a leafy crop it is most responsive to nitrogen. However, for the farmer to obtain a higher return from grassland it is not only necessary to grow bigger and better crops of grass but also to utilize them economically to produce a saleable product. Losses in grazing due to soiling and trampling of the herbage can be minimized by strip grazing. Experiments at Jealott's Hill, Reading University, the Hannah Research Institute and elsewhere have shown that this technique of close folding cows behind a portable electric fence gives a 25 per cent better utilization and a similar increase in milk production per acre over that obtained from fairly intensive rotational grazing. When compared with extensive or range grazing, as is commonly practised, it represents an even greater saving. Furthermore, by using the electric fence grass may be grazed throughout the season at the young, leafy stage, when it is rich in protein and capable of producing meat and milk. Any excess growth at flush periods may be cut for conservation, and not wasted by trampling and soiling due to the understocking which commonly occurs at such times when extensive grazing is practised. In other words, 10 acres of young, leafy grass efficiently grazed using the electric fence can carry as much stock as 12–13 acres rotationally grazed, or about 15 acres grazed extensively. At the same time, it can make a larger contribution to the production ration of the stock—that is, more cows per acre of grass, more milk per cow from grass, and therefore more milk per acre of grass. How important this is, particularly on the smaller farms! Concentrates are rationed for milk production to prevent wasteful "over-feeding", so why not ration grass when it is at the milk-producing stage? It is true that grass is a relatively cheap source of food, but that is still no excuse for wasting it.

Although grass can be utilized most efficiently by grazing, it can also make a valuable contribution to winter milk production as silage, hay and dried grass. Losses in feeding value due to conservation vary considerably, but in normal practice they range from about 10 per cent in grass drying up to 30 per cent in silage-making, and about 40 per cent in haymaking. As with grazing, good-quality grass is necessary to obtain good silage, hay and dried grass from which milk can be produced. Indeed, the importance of quality cannot be overstressed.

The best measure of effective grassland production is obtained by calculating the output (whether utilized as grazing or conserved for subsequent use) in terms of starch equivalent. Alternative methods are to calculate dry matter yields and hay equivalents, but such estimates can be very misleading, because of the decline in feeding value of the pasture as the herbage matures. Thus the production from a heavy crop of fibrous hay, in terms of meat or milk, compares unfavourably in practice with that obtained from lighter crops taken at more frequent intervals throughout the season.

It has been estimated that grassland on British dairy farms has an average output of about 15 cwt. of starch equivalent utilized per acre. This, on an energy basis, is equivalent to 25 cwt. of oat grain. Experience on a number of farms in all parts of the country has shown that outputs of double this figure can be attained under a wide variety of conditions. For example, on the Irish farm previously mentioned, grassland production in terms of utilized starch equivalent was 30.6 cwt. per acre in 1951 and 33.2 cwt. in 1952.

Most of the work on intensive grassland management has so far been devoted to milk production. Grassland, however, provides the basic feed

for beef cattle and sheep as well, and in the good fattening districts outputs of over 4 cwt. of beef per acre have been obtained. There seems no reason why this and higher levels of beef production from grass could not be obtained on a much wider scale by adopting some of the techniques of intensive grass production which have been found to be so effective with dairy cattle. Field work is at present being directed along these lines, both with beef cattle and sheep.

Enough has been said to show that better use can be made of grass as a feedingstuff by the adoption of improved methods of grazing and conservation. The next stage to high output from grassland is to ensure an adequate supply of good-quality herbage for as long as possible in the growing season.

Planned Grazing It is well known that no single pasture type can achieve and maintain a rate of growth sufficient to sustain a high rate of milk production or liveweight increase throughout the grazing season. The different species and strains of grasses each have their own seasonal growth patterns, and our grassland advisers have little difficulty in prescribing a choice of leys to give a satisfactory grazing succession under any specified conditions of soil and climate. Leys of Italian or H.1 ryegrass, when treated with an early spring dressing of nitrogen, provide a most useful "early bite" which can shorten the period of winter feeding by two to three weeks under most conditions, as well as giving a succession of high-quality herbage throughout the spring and early summer. At the same time, these grasses can provide good grazing well into the autumn, particularly when given a top dressing of nitrogen late in the summer, and so shorten appreciably the period of winter feeding. On dairy farms in many parts of the country the ryegrass leys could be combined with a meadow fescue-timothy ley for conservation and midseason grazing, and with a cocksfoot-dominant ley for silage-making in early June, from which the aftermath will have recovered in time for grazing in July-August, when keep tends to be scarce. In dry areas a lucerne ley can also make a valuable contribution to grazing in high summer, while on farms where lucerne is difficult to establish, Italian, H.1 ryegrass or other leys sown in the spring, either by direct reseeding or under a nurse crop (the latter intended for ensilage during the early summer) will make a significant contribution to late summer milk production, when milk prices are beginning to make the seasonal increase. This type of management is a regular feature on the Sussex farm mentioned earlier.

For high output from grass, just as with other farm crops, it is essential to see that there is an adequate supply of nutrients in the soil for normal plant growth. This entails liming for the correction and prevention of soil acidity, and the liberal use of fertilizers. Provided adequate use is made of phosphate and potash, grass is most responsive to nitrogenous fertilizer. Reference has already been made to the use of nitrogen in the provision of early bite in the spring and late bite in the autumn, and this, together with its judicious use throughout the spring and summer, combined with good utilization in grazing and conservation, is the key to increased production from grassland.

Low Cost of Good Grass Even though it may be shown that better use can be made of grass as a feedingstuff, the attitude of the farmer to any suggested change in his methods of husbandry must be conditioned by economic considerations. Not only must he see how the change can be effected, but he must also be satisfied that by adopting it he is likely to increase his total farm profit. However, the experiences and

records which are accumulating from farms where the modern techniques of production and utilization of grass are practised have shown that these techniques pay well.

An example of the low cost of grass as a feed is given in the following table, which shows the cost of the various animal feedingstuffs in terms of their relative feeding values. The cost of growing the various crops has been calculated on the basis of a number of detailed farm accounts for 1952—the latest figures available. The cost of grass production has been similarly calculated, but it should be observed that on the farms concerned grassland husbandry is above average, more fertilizer is applied and there is a greater proportion of the land in leys, with the result that the feeding value of the herbage is enhanced, although the cost of grazing and the conserved grass products will be above average.

Estimated Cost of Starch Equivalent for Various Feedingstuffs (1952)

	Yield per Acre *tons*	Cost of S.E. *£ per ton*
Grazing		10
Grass silage	4.0	18
Hay	1.5	20
Dried grass	1.0	36
Oats, straw fed	0.9* (grain)	22
Kale, cut	20.0	32
Arable silage	5.0	37
Mangolds	20.0	42
Dairy cake (at £35 a ton)		58

* For this calculation 25 cwt. of straw has been allowed for every ton of grain.

In the above table the cost of dairy cake was taken at £35 per ton; but even if the price falls to £25 per ton, the cost of a ton of starch equivalent in this form will be £42, so that it still compares unfavourably with grazing or the conserved grass products.

It should be pointed out that the relative costs shown above do not include cost of feeding and, of course, the bulkier home-grown foods, particularly silage, will be more expensive to feed. Feeding costs will vary from farm to farm, but even with this additional expense grass products are still relatively cheap feeds.

It has now been shown that grassland can provide high yields of feedingstuff at a relatively low cost per unit of feeding value, and herein lies the answer to the question of profitability. Although it cannot be denied that the intensive management of grassland is dependent upon the skill of the farmer, the fact that it is being used successfully on farms in all parts of the United Kingdom is clear evidence of its practical application.

"AGRICULTURE" INDEX

The Index to Volume LX will be issued with the April number.

GRAZING WITHOUT WASTE

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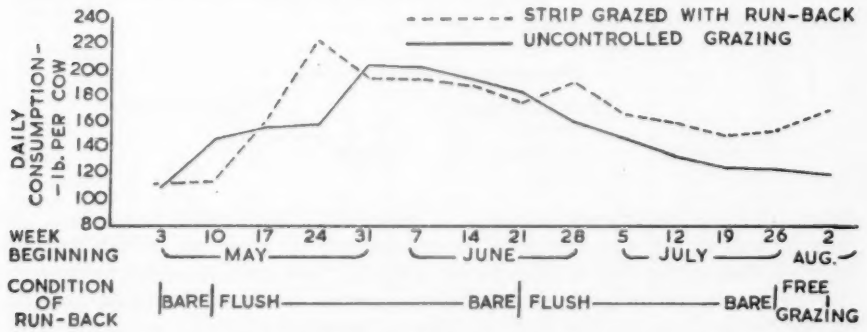
Observations at Sutton Bonington show that, given free pasture grazing, dairy cows will consume far more than is theoretically required for maintenance and production. Strip grazing offers a much more efficient system of management.

IN the course of a series of investigations which were conducted at Sutton Bonington into the problem of measuring the output of pasture, two results emerged which have a practical bearing on the utilization of pasture—namely, the quantities of herbage which the dairy cow will consume, and the residues which remain after grazing under different systems. The opportunity arose when the herd of Dairy Shorthorns was divided into two groups for the greater part of the grazing season, one lot being strip grazed with access to a run-back pasture, and the other allowed uncontrolled grazing. The arrangement was not specially designed to compare the output under the two systems of grazing, but advantage was taken of the situation to determine the quantities of herbage eaten in each case. This determination was made by taking weekly clippings from caged and uncaged areas in the case of the pastures which were free grazed, and from strip cuttings on either side of the dividing wire in the strip-grazed areas, thus providing an indication of the quantities presented to the animals and the residue after grazing. The quantities consumed from the run-back were also assessed. Without claiming too much for the accuracy of the clipping methods, it is felt that the evidence is sufficiently informative to be considered in relation to the utilization of pasture.

How Much will a Dairy Cow Eat? The following diagram illustrates the average quantities of herbage consumed daily per cow during thirteen weeks of the grazing season. The line representing the average quantities consumed by the uncontrolled animals broadly follows the growth curve of the pasture. At the flush of growth these free-grazing animals consumed on average slightly more than 200 lb. of green material per head per day, which, with dry matter contents ranging from 20.2 to 21.4 per cent at that time, amounts to rather more than 40 lb. of dry matter per head per day. This is in excess of the usually accepted standards and certainly more than the quantities which are deemed necessary for maintenance and production. The crude protein content range over that



Average Daily Consumption of Herbage by Dairy Cows under Free- and Strip-Grazing Systems

period was between 16.7 and 18.9 per cent of the dry matter and, according to the formula of Watson and Horton(1), this represents starch equivalents of between 59.4 and 61.0 for the dry matter. Thus the 200 lb. of green material eaten per day theoretically supplied adequate nutrients for the maintenance of an 11 cwt. animal and the production of over six gallons of milk(2).

The strip-grazed part of the herd, with restricted grazing and a bare run-back, at first consumed less herbage per animal, but at that time they were receiving appreciable quantities of supplementary food. When changed over to a run-back which had ample material, consumption rose to a peak of 224 lb. of herbage per animal per day. As the run-back gradually became bare, consumption fell to 175 lb, per head per day, but there was no consequent fall in production of milk, and the group continued to gain weight at the rate of 8.3 lb. per head per week. A change to a more productive run-back resulted in greater consumption but no corresponding increase in production.

It would seem from this evidence that if the dairy cow has access to unlimited quantities of palatable herbage, she will consume far more than she requires, and that restricted grazing, within limits, has no detrimental effect on the production of milk. It was not until the consumption level fell below 140 lb. per head per day in the case of the free-grazed group that noticeable falls in milk yield took place. At that time the herd average was 3.75 gallons of milk per head per day.

Procter *et al.*(3) and Holmes *et al.*(4) have shown that pasture production is materially increased by the use of restricted grazing, and it is suggested that the wide differences which frequently arise when pasture production is measured in terms of utilized starch equivalent and in terms of consumed starch equivalent on the basis of green material and chemical analysis, are primarily due to overeating beyond calculated requirements, with a consequent fall in the efficiency of conversion. Alternatively, can the calculated requirements be wrong?

Residue after Grazing One apparent disadvantage of strip grazing with an intensive rate of stocking is the quantity of material refused by the animals at second and subsequent grazings. Fouling of herbage undoubtedly results in reduced utilization as the season progresses, and the pasture becomes tufted and uneven. The following figures are the averages of all estimates of the proportion of herbage refused after grazing, again determined by the clipping method:

Percentage of Herbage Uneaten

Strip Grazing			Free Grazing
First Grazing	Second Grazing	Third Grazing	
6.1	19.7	34.8	18.6

When all herbage offered is fresh and unfouled, a very small proportion, as determined within the limits of measurement by clipping, is left by the animals, but as the herd is folded over a field for a second time in one season, the quantities refused by the animals increase, and on the third grazing rather more than one-third of the offered material remains uneaten. This quantity could well nullify any advantage which strip grazing may possess over free grazing. Under conditions of free grazing, to the extent that the

pasture was bared of all palatable material, the average residue proved slightly less than that of the second strip grazing.

It is widely recognized that mixed stocking frequently results in a more evenly grazed pasture and, by virtue of the greater utilization of the herbage, to higher production. To overcome the disadvantage of strip grazing it seems, therefore, that alternate grazing with other classes of stock or alternate grazing and mowing for silage or dried grass may well result in more efficient utilization of the herbage which is produced.

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AGRICULTURAL INDEX NUMBERS AND PRICES

MONTHLY INDEX NUMBERS AND PRICES OF AGRICULTURAL PRODUCTS

INCLUDING EXCHEQUER PAYMENTS (UNCORRECTED FOR SEASONAL VARIATION)
BASE 1927–29 = 100

	Unit	Prices used for Dec. 1953 Index	1953			1952		
			Oct.	Nov.	Dec.	Oct.	Nov.	Dec.
All Products ..	—	—	291*	304*	308*	291	305	312
Cereals and Farm Crops	—	—	244	251	260	242	248	258
Livestock and L'stock Products	—	—	304*	319*	322*	306	323	329
		s. d.						
Wheat	cwt.	31 4	285	294	303	273	281	290
Barley	,,	28 1	257	255	255	273	270	273
Oats	,,	22 5	248	243	242	276	278	280
Potatoes	ton	241 6	215	225	240	210	220	235
Hay	—	—	184	184	187	183	191	198
Fat cattle ..	live cwt.	127 2	249	247	258	235	231	241
Fat cows ..	,,	66 1	191	187	188	191	180	182
Fat sheep ..	lb. d.w.	2 5½	214	222	231	216	216	224
Fat ewes ..	,,	1 6½	218	221	224	212	215	218
Bacon pigs ..	score	56 3*	377	375*	369*	362	362	362
Pork pigs ..	(20 lb.)	58 6	353	350	346	299	299	299
Sows	d.w.	26 5	241	236	230	238	238	238
Milk	gallon	4 0.9*	344*	372*	376*	338	368	376
Butter	12 lb.	40 0	190	190	190	168	171	171
Poultry	—	—	213	230	259	248	255	276
Eggs	120	48 9*	266	276	268*	319	335	335
Store Stock†		£ s. d.						
Dairy cows ..	head	62 4 0	220	228	230	217	221	220
Store cattle ..	,,	40 6 0	283	284	277	256	254	249
Store sheep ..	,,	7 5 6	253	258	269	222	225	232
Store pigs ..	,,	8 18 3	480	475	473	459	452	462

* Provisional † Not included in general index

THE FEEDING OF IODINATED PROTEIN AND THYROXINE TO DAIRY COWS

RECENT BRITISH FINDINGS

PROFESSOR H. D. KAY, C.B.E., D.Sc., F.R.S.
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The temporary stimulation of declining milk yield is shown to be best achieved by feeding pure synthetic thyroxine mixed with the concentrates ration.

IT has been known for very many years that the thyroid gland is closely associated with the "basal metabolic rate", that is, the rate at which the resting body "ticks over". This rate can be measured by determining the rate at which oxygen is used, or carbon dioxide given out, by the human or the animal, under resting conditions. That the feeding of dried thyroid gland, or thyroid gland extracts, to man or animal will increase this basal metabolic rate has also been known for many decades.

Baumann in 1895 found in the thyroid gland a substance containing iodine in organic combination—later shown to be an iodine-containing protein. It was not, however, till 1916 that a simpler crystalline substance known as thyroxine, an amino-acid containing a large proportion of organically combined iodine, was isolated from the thyroid gland. The chemical composition of this substance was determined by Harington in 1927. Thyroxine was found to be extremely active in increasing the basal metabolic rate when given either by mouth or by injection.

Thyroxine and the Cow The effect of the thyroid gland on milk secretion in the cow was first examined by Graham in 1931, working in the present writer's laboratory. Whilst studying the various circumstances in which the fat percentage in the milk of the cow was raised, the conclusion was reached that in many cases there was evidence of increased metabolic activity in the animal. The obvious experiment, of directly raising the metabolic rate by feeding to lactating cows either thyroid gland or thyroxine and determining the subsequent changes in the milk, led to the findings that not only was the fat percentage in the milk increased but the daily yield of milk was also appreciably raised. Unfortunately, at that time both the crude, dried thyroid tissue and the pure thyroxine were very expensive and the improvement in milk yield and quality that could be obtained in this way was quite uneconomic. Graham's findings were abundantly confirmed and extended by later experiments at the N.I.R.D. These showed, amongst other findings, that quite small doses of thyroxine—as little as one three-thousandth part of an ounce per animal per day—if injected subcutaneously, provided a most effective, though still not an economic, way of obtaining an increase in milk fat percentage and in milk yield. In other research laboratories abroad, similar results were obtained, but any immediate practical application of these interesting findings seemed at that time (1935) unlikely. No one in his senses would advise the dairy farmer to make a daily tour of his cowshed with a hypodermic syringe!

The whole situation was given a twist towards the practical when in 1939 Ludwig and Mutzenbecher found that if casein was carefully treated with iodine, the iodine-containing protein so obtained was capable of producing a marked increase in metabolic rate when fed by mouth to human beings;

that is, it had a similar effect to that of thyroid gland or thyroxine. It was, in fact, shown that the big molecule of the iodinated casein contained thyroxine as one of its constituent amino-acids. It apparently did not occur to these workers, interested mainly in the medical implications of their discovery, to try the effect of their new product on lactating cows. The publication of this work, however, led the small British team which had carried out the thyroxine work just mentioned to the realization that, since the raw materials casein and iodine were not expensive, here might be a potentially cheap source of a substance, capable of being fed by mouth, which might be used in an ordinary dairy herd to increase milk yield and butterfat production. Some of the iodinated protein was, therefore, prepared in the Shinfield laboratories and shown to increase milk yields.

The manufacture of sufficient iodinated protein to permit of a trial on a field scale was, however, beyond the possibility of a small research laboratory; it required a plant of industrial size. Under the auspices of, and with financial assistance from, the Agricultural Research Council, a large-scale field trial was planned, a pharmaceutical firm was commissioned to prepare sufficient of the iodinated protein, and commercial farms in different parts of the country were encouraged to take part. It was clearly shown that a course of treatment with iodinated casein, lasting for six weeks, would in the great majority of animals produce a marked temporary increase in milk yield without affecting, so far as could be judged, the health of the treated cows. In this experiment the iodinated protein was incorporated into cubed feeding-stuffs, the proportion being so arranged that the appropriate daily dose of iodinated casein was contained in 4 lb. of cubes. The results were published in 1944. A short review of these and some subsequent findings was given in this JOURNAL in December, 1950 by Blaxter*.

The Questions The Agricultural Improvement Council, having considered both the findings of the field experiment just mentioned and other ancillary investigations, came to the conclusion that before official approval could be given in Britain to this method of stimulating dairy cows to increased yields, more information was needed on several questions. In particular, the Council wished to know (a) what part the additional cake, which was fed in the iodinated-protein-containing cubes in the field trial, itself contributed to the increased milk yields that had been reported; (b) what would be the long-term effect on the health, etc. of the cows of feeding iodinated protein (i) for long periods in a single lactation, (ii) in two or more lactations; (c) what were the milk yield responses at different seasons of the year.

A carefully planned and lengthy series of experiments was needed to provide this additional information on an unequivocal basis, and a group of research workers, most of whom had been concerned in the earlier field and laboratory experiments, was reconstituted by the Agricultural Research Council to plan the new work and make the necessary arrangements. The experiments so planned included large-scale field trials, extending over more than three years, together with a number of smaller-scale experiments, mainly carried out at the various research institutes interested—the N.I.R.D., the Hannah, the Rowett, and the Ministry's Veterinary Laboratory. This extensive programme was eventually completed in 1952-53 and the findings have been statistically examined.

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* Iodinated Protein and Lactation. K. L. BLAXTER. *Agriculture*, 1950, **57**, 413–7.

The Answers The answer to the first question—(a) above—was obtained fairly early, in a trial in which 410 pairs of cows on well-managed dairy farms in thirty-two counties of England, Scotland and Wales were used. It was found that the effect of 4 lb. of normal cubes per day in addition to the normal ration was slight—of the order of 0.1 lb. of milk per 1 lb. of cubes. The cubes containing iodinated casein, on the other hand, produced in strictly comparable animals an average of 0.7 lb. of milk per lb. of cubes. Thus the effect of the additional cake, though relatively small, was not negligible.

As regards the answer to question (b), the main assumption made in planning the experimental work was that whilst health could only with great difficulty be measured directly (particularly in a large-scale field trial with commercial herds), the economic life of an animal in a herd could be assessed far more readily. Economic life afforded a combined index of both productivity and health. It could be found from a study of disposal rate, since in the commercial dairy herd the major proportion of disposals occurs only when the culled animals have, for some convincing reason, become of distinctly less economic value as milk producers than the rest of the herd. In addition, veterinary examination was made and health records kept of all the experimental and control cows used.

It was necessary, of course, to conduct this trial on herds which were well-managed and also recorded either under National Milk Records or under the Scottish Milk Records Association. In the event, complete data were obtained from thirty-two herds, with a total of 1,172 lactations in treated animals and approximately the same number in untreated controls. These data came from 500 treated animals during one lactation and lesser numbers during two or three lactations. Half the cows in each herd were given cattle cubes containing iodinated casein, the weight of active material in each batch of cubes being based on a previous biological assay of the potency of the iodinated material, an assay by no means easy to carry out and the cause of some exasperating delay before the start of the field trials. The period of iodinated protein feeding was begun twelve weeks after calving, and continued for eight weeks at full dose. After this period there followed a tailing off period of three weeks during which the dose was gradually reduced until the diet of all the animals was normal again.

Synthetic Thyroxine Whilst this large-scale trial was in progress, a new method developed in this country for the synthesis of thyroxine made this substance available at a competitive price. Thyroxine has the undoubted advantage that, once it is in a pure form, it need not be put through the tedious and rather inexact process of biological standardization. Further, though there was trouble with palatability with some batches of iodinated protein, thyroxine presented no problems of this kind, and in practice had other substantial advantages over iodinated protein. In a pilot experiment, it was shown that the potency of the synthetic thyroxine ("L-thyroxine") fed by mouth was such that the daily dose was only one three-hundredth of the weight of iodinated casein required to produce the same increase in milk secretion. Thereafter the planning group decided to use thyroxine instead of iodinated casein for a substantial proportion of the experimental cows.

The following results were obtained from the large-scale field trial, answering questions (b) (i) and (b) (ii):

1. Over the eleven-week period of the trial, the treated animals had a higher average yield than the controls. The *total lactation yield* of milk was not greatly affected by the treatment. There was a slight depression in the first and second lactations, due largely to the fact that the duration of the lactation was reduced to some extent, but there was a slight increase in the third and subsequent lactations.

2. The rate of disposal of cows was not affected by the treatment, nor was there any striking effect on health as judged by the incidence of disease, even after giving the material to the same cows for a part of each of three successive lactation periods. Digestive and metabolic disturbance was very slightly greater, and the incidence of mastitis rather less, in the treated animals than in the controls.

3. The reproductive life of the cows, as judged by the effects on service period, number of services needed, calving abnormalities and length of gestation was not changed to any measurable extent.

As regards the answer to question (c), whilst winter treatment appeared to have a rather greater effect than treatment at other seasons of the year, it was not very marked. Animals treated in the spring tended to have their lactation periods shortened by the treatment to a greater extent than animals treated at other seasons. The effect, however, was in both cases small.

Supplementary experiments gave additional findings as follows:

1. In a trial with four herds, in which doses of iodinated casein were given over longer periods than in the field trials just described, it was found that whilst the results confirmed the utility of a *short* course of treatment—say, six to eight weeks and starting some twelve weeks after calving—the milk yield response began to fall off between the eighth and the tenth week of treatment and to disappear completely by the twelfth week. Some self-righting ("homeostatic") mechanism seemed to be aroused in the cows, which after some weeks counteracted the effect of treatment.
2. Another experiment, to compare the effects of iodinated casein treatment as between animals (a) on a normal, (b) on a high plane of nutrition (25 per cent increase in the production ration), showed that both the normal and the high plane animals gave the same initial response in increased milk production, but that the response of the normal plane animals fell off sooner and rather more quickly than that of the high plane group.
3. Other work carried out under the auspices of the planning group showed that thyroxine and thiouracil (a drug which diminishes thyroid activity) had opposite effects on milk yield and quality.
4. A small experiment showed that the feeding of iodinated casein to cows had no measurable effect on the cheese-making quality of the milk.

Conclusions The main lessons, including some of the older ones as well as the new, are:

1. Pure L-thyroxine appears to be preferable in most respects to iodinated casein as an agent for temporarily increasing milk yield of cows in declining lactation.
2. Thyroxine given by mouth in doses of up to 80 mg. per day, suitably admixed with concentrates in cattle cubes, appears to be the handiest and probably the cheapest form in which to feed thyroid-active materials to cows.
3. Periods of treatment should not exceed six to eight weeks at most.
4. Older cows give better results on the whole than younger cows.
5. If the amount of thyroxine mentioned in 2 and the period of treatment

mentioned in 3 are not exceeded, neither the immediate nor the long-term effect on the health of the cows is significant (at least in well-managed herds), although if twice this amount is fed, adverse effects may follow.
6. Total lactation yields are not markedly affected by thyroxine treatment.
7. The season of the year has little influence on the magnitude of the effect produced by thyroid-active materials.
8. For producing an increase in milk yield at specific periods of the year, the administration of synthetic thyroxine may be economic.
9. Milk from cows given iodinated casein does not contain any thyroid-active material, so that it is safe for public consumption.
10. The most suitable period of the year in which to use thyroxine or iodinated casein (if they are used at all) is for not more than six to eight weeks in the late winter months, the time being so arranged that as the thyroxine dose tapers off the spring grass is becoming available.

Certain objections still remain:

1. Overdosage with either iodinated casein or thyroxine (the former being rather unpalatable and the latter more palatable and therefore potentially more dangerous as being less likely to bring about refusals in the cow if given in excess) will lead to untoward effects.
2. Either of these materials may be used for faking milk yields and milk records, especially short-term ones.
3. The additional food the cow needs to meet the joint demands of increased metabolic rate and increased milk yield are by no means small, and at the season of the year when the extra yield would be most welcome, may be difficult to obtain and expensive to buy.
4. If iodinated casein or synthetic thyroxine becomes freely available, its use in herds other than those in which the management and supervision is good or very good may lead to trouble and disappointment.

It is probably not incorrect to say that if the additional money, concentrates and care in management needed to carry out successfully a thyroxine-stimulated boost in milk yield or quality were put into the average British herd in the absence of this stimulant, the results in increased milk yield might be surprisingly close to those induced by the thyroxine technique. They would in any case be achieved without the risks of feeding this highly potent material, though as I have endeavoured to make clear, the risks are considerably less than was at one time supposed. Thyroxine or even iodinated casein may in the future find some small place in dairy herd management in this country. The latter stimulant has already found such a place in the U.S.A.

Some Articles of Outstanding Interest

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PARASITOLOGY OF DEEP LITTER

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Little is yet known of the build-up of the parasite population in deep litter and its reaction to physical factors produced in the course of fermentation. Dr. Horton-Smith here sketches some of the findings at Houghton to date.

AS our observations on deep litter at Houghton have not yet covered a full year, and have been concerned with only one sort of litter, much of the substance of this article is speculative, and what is written now may have to be modified as our investigations continue. The subject is made difficult by the complexity of the medium, the changing ecology of it at different depths as it matures, and by the constant movement of it by the birds' activities. Basically, the nature of the litter at different stages is dependent on the degree of fermentation produced by bacterial activity. In studying the parasitology of deep litter, we must carry out a series of observations on the parasite populations of fresh litter and extend these observations through the maturing processes. The parasitologist is only too willing to pass to the bacteriologists and chemists the complicated issues of bacterial activity and the study associated with the identity of the bacteria themselves. The parasitologist must use the initiation of fermentation as his starting point and thereafter study the effects of fermentation on the parasitic stages present in the litter.

Four requirements have been laid down by Bott *et al.** for the proper functioning of deep litter. They are:

1. The depth of litter should be greater than six inches to ensure the absorption of fresh droppings and for effective chemical and biological activities.
2. So that the litter may be maintained in a fully absorbent state, it should be stirred whenever caking begins. Stirring also removes droppings from the surface and so permits various reactions which result in the breakdown of such materials.
3. Moisture must be present for the various chemical and biological activities. The moisture is provided by the droppings and watering devices and by absorption from the atmosphere.
4. Heat is necessary for the reactions to take place.

Effects of Physical Factors on Parasites In approaching the problems associated with the parasitology of deep litter, one aim has been the study of the physical factors that might adversely affect the free-living oocysts of coccidia and ova of worms. From laboratory experiments we know quite a lot about such things as temperature and moisture, and their influence on these stages. Therefore, recordings were kept of the temperatures attained at different depths and of the moisture content of the litter. As there is a considerable amount of ammonia evolved in maturing deep litter, and as it is known that oocysts are extremely sensitive to it, estimations of ammonia were made each week. The viability of the oocysts and ova population of the litter were tested regularly as the litter matured, and tests of the effects of the various factors were also made in the laboratory.

* The Influence of Litter on the Control of *Salmonella* Infection in Chickens. C. W. BOTT, L. C. FERGUSON, J. M. BIRKLAND and A. R. WINTER. *Amer. J. vet. Res.*, 1952, 13, 562-5.

Laboratory tests show that oocysts in watery suspensions are killed after fifteen minutes' exposure to a temperature of at least 125.6°F. But in our experiments the maximum temperature at the surface of the litter in a deep litter unit never exceeded 90°F. On the other hand, when the litter was heaped, the temperature ten inches inside the pile and four days after heaping was 140°F. Oocysts in faeces and in watery suspensions introduced into the position at which the temperature was taken were dead when they were examined at the end of twenty-four hours. On the whole, we may say that oocysts are not killed by heat in unheaped litter and, in certain cases, the temperature may be close to the optimum temperature for sporulation of oocysts. As would be expected, there is greater variation of temperature at the surface than at lower levels. Moisture and ammonia production increase with depth, there being a difference of roughly 7 per cent in moisture content between the surface litter and that at the base.

The following example will serve to show the relationship existing between moisture and ammonia production.

Position from which sample of litter was taken	Ammonia present	Moisture	Temperature (°F.)	
			Maximum	Minimum
	mg. per cent	*per cent*		
Surface	75	29.0	62.5	51
Middle	111	31.15	68.5	58
Base	137	35.55	68.5	62

Laboratory experiment has shown that 100 mg. per cent of ammonia is lethal to oocysts exposed to this concentration for four days. Provided the oocysts remained in the same relative positions in the litter, it can be assumed that they would remain viable at the surface but would be destroyed at the middle and base. Litter-faecal mixtures maintained in tin boxes afford some information as to what happens in deep litter undisturbed by chickens. Samples taken from the surface and base of such litter eight days after the mixture had been placed in tins showed that ammonia was present at the surface to the extent of 90.64 mg. per cent. But at the base of the litter the concentration was found to be 169.0 mg. per cent. The moisture content at the surface was 21.5 per cent and, at the base, 43.5 per cent. Unsporulated oocysts were introduced at the surface and the base of the litter. There was some sporulation at the surface but none at all at the base. These observations suggest that the ammonia generated is probably the most important single factor in destroying oocysts.

The effect of ammonia on worm ova is a very different matter, and much more work is necessary before we can be at all dogmatic about it. A high concentration of ammonia—say, 1,000 mg. per cent—inhibits the development of the ova of *Ascaridia* and *Heterakis* after four days' exposure under laboratory conditions, but this concentration is probably never attained in the deep litter house.

Coccidiosis a Potential Danger The constant movement of the litter through the birds' activities will tend to turn the surface matter to the base and back again. This may mean that many oocysts are not exposed sufficiently long to concentrations of ammonia that are high enough to destroy them. In other words, there will always be a

certain number of viable infective oocysts and worm ova present. This is evident from counts carried out on samples of litter taken from a variety of deep litter units. Rarely do we find a complete absence of parasites. Furthermore, if we isolate birds which have been raised on built-up litter and examine their droppings, we almost invariably find coccidia and worm ova. We cannot assume that parasites are completely absent, even in properly functioning litter. As a few ingested oocysts will eventually produce a considerable rise in the ground population of coccidia, the fact must be faced that coccidiosis is a potential danger of the system: fully-developed worm ova, which are more resistant to the conditions of deep litter, will remain a potential source of worm infestation. Susceptible chicks placed on established deep litter for a period have proved resistant to challenge doses of coccidia which have killed related chicks kept in isolation. This development of resistance not only indicates that viable coccidia are present in established litter, but it also raises the point that proper management of deep litter may reduce the coccidial population to non-disease-producing, yet immunizing, proportions. This is an ideal situation, but the problems of how to ensure it are as yet unsolved.

In our experience, coccidial outbreaks have been most commonly met with on litter which has not been built up to the correct level to encourage bacterial and chemical action—not only will really deep litter encourage these activities, but it will also tend to dilute the parasite population voided by the birds, so that each bird will pick up relatively fewer oocysts or worm ova. Opposed to the development of immunity, there is the maintenance of susceptibility to parasitism arising from the isolation of birds from all sources of infection, a situation that might occur as a consequence of the too frequent changing of litter, or its too perfect working. Birds leaving such litter will readily fall victims to disease when transferred to other forms of management. To sum up, although parasites may survive and even produce disease in birds on built-up litter, conditions could exist which would regulate the intake of viable infective oocysts so that resistance, rather than disease, is developed.

Other Diseases Although we have gone a fair way towards understanding the reactions of parasites to new and established built-up litter, we have hardly considered the effect of this form of management on other diseases. Admittedly the bacteriologists and virologists have almost insuperable difficulties to overcome in an investigation of this sort. Other diseases are found in birds on deep litter—for example, blackhead in turkeys, fowl paralysis, coryza, fowl pox, Newcastle disease and aspergillosis have all been identified. What is poison to the coccidia may be food to the host of other undesirable organisms—we simply do not know. Another complication arises in that the early diagnosis of disease is not always possible when one is dealing with a large number of birds, often closely confined, and it might be of advantage to adopt courses of prophylactic treatment to forestall the development of epidemics.

As I have said earlier, much more work remains to be done. The physical conditions existing in maturing and mature litter of all types must be studied, as well as the reaction to these conditions on the parasitic populations within the litter. The whole question of built-up litter and its relation to disease must still be approached with considerable caution.

PROGENY TESTING IN THE BREEDING OF WELSH MOUNTAIN SHEEP

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The results obtained after fifteen years of work on a Caernarvonshire upland farm suggests that progeny testing to select breeding rams offers far better prospects of flock improvement than the more usual practice of judging the ram purely on physical appearance.

THE last ten years or so have seen a growing interest in breeding and improvement among those who keep sheep under the more rigorous conditions of our upland and hill farms. This has been shown by an active movement towards the improvement of the hardier type of Welsh mountain sheep by careful selection of rams from among the hill flocks themselves, and several new local societies for that purpose have recently come into existence as a result. But although there is a general unanimity of opinion that greater attention must be paid to hardiness in hill stock, opinions about the other aims in breeding Welsh mountain sheep vary a good deal. When methods of attaining those aims come under discussion, the confusion seems to be even greater.

The usual method of breeding among the great majority of breeders of Welsh mountain sheep in our district is to buy a number of new rams each year from other flocks. These rams are usually disposed of after being used for two seasons, and it is the exception for a ram to be kept for a third season. Selection is based mainly on physical excellence, this being often greatly enhanced by good nutrition. In fact, a strong belief is held that only the best can produce the best.

This was our own system, too, until gradually we saw that, in spite of all the care we took in selecting rams, we were making no real progress; we had practically no control over our material, and such stock as we produced showed great variation in almost all of the characters which we aimed at improving. It was with the conviction that there must be a better system that we tried to find out something of the methods of the great breeders of the past, and what the science of genetics had to offer. Finally, we decided that neither science nor tradition could indicate any better method than the progeny test, coupled with a policy of line breeding.

A Practical System Our farm is a mixed one of 100 acres, lying between 500 and 700 feet in North Caernarvonshire. The ewe flock of 160 is kept entirely on the farm from the end of October until its return to the mountain sheep walk with lambs at the beginning of May. They remain there throughout the summer months at an altitude varying between 2,000 and 2,800 feet, except when they are gathered and brought down for shearing in July, and again for dipping at the beginning of September. At this last gathering the lambs are kept down, the ewe lambs to await being sent away to winter grazing on lowland farms, and the wethers to be fattened on aftermath and a little rape. The ewe flock returns to the sheep walk until the last week in October, when it is brought down for tupping.

Any attempt to apply a progeny test to Welsh mountain sheep is severely handicapped at the start by the wandering instinct and agility of both ewes and rams, and by the absence on most Welsh hill farms of enclosures where each ram can be kept with his allotted number of females. Consequently,

we have had to spend both time and labour on making some sections of the farm reasonably sheep-proof.

The system we have adopted is as follows. Each ram which is being subjected to the test for the first time is put on his own with about ten to fifteen ewes, chosen to include some of all ages—that is, 1½, 2½ and 3½ years old—and to be as representative a sample of the flock as possible. The ewes in each lot are marked with a distinguishing paint mark (which will remain until lambing time) and are kept with the ram until the beginning of December, when the whole flock is again mixed. At lambing time, the ewe's paint mark is duplicated on her lamb. This is done daily when each lamb is injected with serum against lamb dysentery, so that there is little chance of any lamb being wrongly marked. The paint marks on the lambs remain until September, when the progeny of each ram are given an identifying tattoo in the ear. A single letter denoting their sire is all that we have found necessary; this letter enables us to recognize the progeny of each ram with certainty at any time during their lifetime.

Anyone who has never tried progeny testing with sheep may be led to assume that, having done these things, it is only a question of waiting for the end of lambing time before the best sire can be identified. But in practice it is not as simple as that. In dairy cattle, selection is mainly for weight of milk and butterfat content, both of which can be measured directly in a bull's daughters, and the application of the progeny test is therefore reasonably straightforward. With hill sheep, however, the characters for which we try to select are not nearly so readily assessed. The first essential is undoubtedly hardiness—almost certainly the most difficult character to define or assess. Most hill farmers associate it with a particular type of fleece, usually a hairy or kempy type with an undercoat of fairly close wool, and an overcoat formed of the lash of protruding hairy fibres. But other factors no doubt contribute to the sheep's ability to thrive under adverse conditions: a moderately thick skin, a strong constitution, and vigour, coupled with the instinct to make use of any available shelter in bad weather—all contribute to the making of what we call a hardy sheep.

Then again, we must try to select for milking ability, fecundity, longevity (coupled with an ability to "wear" well), and sound teeth which remain serviceable until the ewes attain a good age. Finally, we have to breed for good growth under hill conditions, and a reasonable ability on the part of the wether lambs to fatten, because the sale of store wether lambs, or fat lambs finished on our own aftermath and rape, is a considerable item in our economy.

Because of the many diverse characters we seek, our chances of finding a sire whose progeny excel in all of them become very remote. Again, some of the characters we seek may actually be incompatible; for instance, ability to fatten, being associated with early maturity, may be incompatible with good growth under hill conditions, and indeed with the essential nature of hill sheep.

Assessing the Value of the Ram It is obvious that selection for many of the characters named above can only be done by continued observation of the daughters of each ram throughout their lifetime. We have found that an attempt to compare daughters with their dams is neither practicable nor necessary. This view is in accord with the findings of McMahon(1) in New Zealand, who suggests that the offspring alone serve as a measure of breeding performance of rams, and that seven

offspring are a sufficient number to establish a ram's worth. Similar views were expressed recently at the Cambridge Bull Breeders' Conference in relation to bull testing(2). We consequently feel that we are on sound lines when we sort out the progeny of each ram into separate pens at weaning time in September, and compare the separate lots for type of coat, conformation, growth, uniformity, etc.

The first comparison will show at once whether any ram is particularly prepotent (that is, leaves offspring of a particularly even type) and is therefore homozygous (or capable of passing on identical genes) for many of his most important characters. This, in itself, we have found to be a valuable result of the progeny test, for the ram which leaves an uneven lot of lambs betrays his mixed inheritance, and breeding with such an animal will give us little control over what we are trying to do.

Further, this initial comparison, while not enabling us to decide finally which ram is going to raise the standard of our flock, does enable us to find those rams which pass on undesirable characters, such as a poor birth coat, poor growth, black lambs, etc., and to get rid of them before they have an opportunity of lowering the average of the flock by extensive use. We can thus make a broad selection from those rams under test when their offspring are six months old, and all those showing promise are further assessed when their ewe lambs return home from wintering at twelve months old, again when they are brought down for shearing, and at eighteen months, when they come down for tupping.

It is our experience that a fairly reasonable assessment of a ram on the quality of his offspring can be made when the latter are 2½ years old, but it is obvious that his full worth as a sire of hard-wearing, long-lived hill sheep can only be discovered when his daughters reach drafting age at 4½ or 5½ years old. He will then be at least 5½ or 6½ years old; hence it follows that the test should be applied to rams as early as possible, preferably as ram lambs or shearlings, so that when an outstanding sire is found he may still be sufficiently young to give several years' service. When an outstanding sire is discovered it is necessary to try to make as much use of him as possible and to select some of his sons for testing. We have found that sons of a proven sire are far more likely to prove good stock-getters themselves than are sons of sires which beget variable stock.

Success with Line Breeding In a small flock such as ours, it soon becomes difficult to avoid inbreeding if sons of a proven sire are being used for longer than two seasons. Introducing new blood by buying in new rams is almost out of the question: any ram bought must be put under the progeny test, and only when his stock proves on comparison to be equal to that of our own proven rams can we venture to use him more extensively.

On the other hand, we have sometimes found it necessary to try to conserve the good inheritance of a particular ram by line breeding to him. The usual method recommended by geneticists is to mate half-brothers to half-sisters—that is, sons of a proven ram to their half-sisters out of the same ram. We have used this method, and have found that it leads to much greater control over our material. But when doing so, we have taken the precaution of mating a ram with a few of his half-sisters at first, and in any case his stock must have previously proved satisfactory. Every inbred mating is looked upon as a trial until its results are seen. Any inferior progeny of such a mating show, not the evil results of inbreeding, but how

Right: *Sheep in the Snowdon area on the way down for dipping.*

Norfolk County Council

Wells-next-the-Sea, Norfolk Januar

Januar

1953 Mablethorpe, Lincolnshire

1954

EAST COAST SEA FLOODS RECLAMATION (See pp. 577-9)

Canvey Island, Essex January 1954

Sandilands, near Sutton-on-Sea, Lincolnshire January 1954

far our stock contains recessive factors for defects and weaknesses. If the proportion of inferior offspring is high, we stop line breeding to that particular sire. Occasionally, hidden weaknesses in the strain, such as lethal or semi-lethal factors, have cropped up; we found this particularly when we first began to line breed. When they occurred, we were able to trace the source of the weakness and eliminate it.

If one wants to find out quickly what there is in the genetic make-up of an exceptional sire, then mating him to four or five of his own daughters will show whether he carries any genes for undesirable characters or not. We have used this method with advantage, and have found that when a sire produces offspring from his own daughters equal in quality on the average to his daughters from unrelated females, then it becomes well worth mating him with a larger number of his best daughters. In this way we have produced animals carrying a higher proportion of the genes of a particular sire in a homozygous state, and equal to their less closely bred mates in growth, vigour, and type. Ram lambs bred in this way are far more likely to prove prepotent when subjected to the progeny test.

Finally, one must not overlook the value of the proven dam in breeding. It is well worth making a note of any ewe which produces outstanding offspring year after year. When such a female is found one may be fairly certain that she herself is passing on a valuable gene complex, and that she is homozygous for many of the important genes. By mating such a ewe to our best proven ram, we have bred ram lambs which have been of great value in raising the standard of our flock.

Some Conclusions After fifteen years of progeny testing we can say that, working on the method outlined in this article, we have found it to be of immense value in the breeding of hill sheep. By its use we are satisfied that we have raised the standard of our flock steadily but surely in most of the important economic characters. Our sheep have gained in vigour and hardiness, our type is far more even, and we have far fewer inferior types among both ewes and wether lambs. From this work a number of broad conclusions may be drawn, as follows:

1. Progeny testing is a long-term policy and a slow job, because no ram can be really proved until he is at least 5½ years of age. It does not do away with the value of the stockman's eye. On the contrary, the visual assessment of the value of a ram's offspring is invaluable and indispensable.

2. We have had clear evidence that sound teeth are strongly inherited, and can be bred for. One ram we tested some years ago had daughters which kept their teeth until 8 and 9 years old. At the same time we had a ram whose daughters mostly became broken-mouthed at 4 years old. The contrast between the progeny of these two sires, out of ewes of similar breeding and under exactly the same conditions of grazing and nutrition, brought home to us the strong influence of heredity on teeth. The value of the good inheritance transmitted by the former ram only became fully evident when some of his daughters were seen to have a full set of teeth at 8 and 9 years. It is clear that a sire's influence on the teeth of his daughters cannot be assessed before he becomes at least 5½ years old.

3. The use of the progeny test, and the extensive use of any good stock-getters which are found, gives the breeder control over what he is trying to do. Continual out-crossing does not do so.

4. If it becomes necessary to buy rams from other flocks, the safest bet is to buy sons of a proven sire, if one is known. Alternatively, find which

breeder has the evenest type of sheep; this denotes a greater degree of homozygosity than the average, and rams from such a flock are more likely to be prepotent.

5. Inbreeding with average stock is pointless. It should be resorted to only when a ram is found whose stock is quite definitely well above the average. It may take many years of ram testing before you find such a ram, but when you do he should be used to the utmost, so as to spread his good heredity as widely as possible throughout the flock. Our present ewe flock is made up of daughters and grand-daughters (with a good number of double grand-daughters) of a well-tried, proven ram.

6. Do not be surprised when you find that your best ram (on appearance) does not sire your best stock. The biggest surprise we have had since we began progeny testing was to find that the stock with the best conformation were sired by a ram whose own conformation was far from desirable, having a high shoulder and a sloping rump! We have similarly found that the best-coated ewes are those sired by a ram whose own coat left much to be desired.

Close observation over many years of the progeny of the various rams we have had under test has only emphasized further the futility of trying to evaluate the breeding value of a ram from his own physical superiority, and hence the great value of the progeny test in any constructive breeding programme. Our own rather limited experience has led us to conclude that the adoption by more breeders of such a breeding policy as we have outlined here would raise Welsh mountain sheep to higher planes of excellence and productivity.

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The Jones-Bateman Cup for Research in Fruit Growing

The Jones-Bateman Cup, presented by Miss L. Jones-Bateman, of Cae Glas, Abergele, in 1920, for the encouragement of fruit production, is offered for award triennially for original research in fruit culture which has added to our knowledge of cultivation, genetics, or other relative matters. The Cup is offered for award in 1954.

Candidates should submit accounts of their work by October 31. The work dealt with should have been carried out by the candidate mainly in the United Kingdom and mostly during the last five years. The Cup will be held for three years by the successful candidate, who must give a bond for its safe return. The holder will be able to compete again on future occasions. When the Cup is relinquished the holder will receive a Hogg medal, which will be struck in gold if conditions allow. There will be three Assessors (two appointed by the Royal Horticultural Society and one by the National Farmers' Union) and they will report to the Council of the Society upon the originality and comparative potential value to the fruit-growing industry of the work of the candidates.

EAST COAST SEA FLOODS RECLAMATION

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Ministry of Agriculture and Fisheries

The East Coast sea defences of Great Britain shattered in the storm on the night of January 31, 1953, are once more intact. The story of how, within twelve months, they have been restored and strengthened, reflects the greatest credit on all who have been engaged on this gigantic task.

THE storm which affected the East Coast of the British Isles on the night of January 31, 1953, was probably the worst natural disaster in this country for three hundred years. The extraordinary weather immediately before the floods caused water to pile up at the northern entrance to the North Sea. The direction of the wind then changed suddenly, so that the piled-up water was blown down the East Coast with the tide, raising sea levels by nearly ten feet and lashing the sea into furious waves. Much damage was done throughout Britain, especially to forests in Scotland, but the part worst hit was undoubtedly the east, where damage occurred all the way down the coast from Northumberland to Kent. The sea defences most severely hit were those from Holderness to the Isle of Thanet; between these places not a mile of sea wall remained intact.

As a result of the disaster, three hundred people lost their lives and 24,000 homes were flooded and damaged. Water supplies were stopped, wells contaminated with salt, and sewerage services interrupted. Many power stations, gasworks and factories were put out of action and hundreds of miles of roads and railway were damaged and made useless. Over 160,000 acres of agricultural land were flooded by salt water, and sand and debris were scattered over large areas. Little of this land produced a worthwhile crop in 1953, and much of it may take three to four years to restore to normal production. Of the animals, 1,100 cattle, 9,000 sheep, 2,600 pigs, 34,000 poultry and 70 horses were lost.

All-out Effort The response to the disaster was immediate, and 30,000 men and 500 excavators and bulldozers were soon at work. Over half of these men came from the fighting services: their help was magnificent. The immediate task after saving lives was to patch the sea walls to keep out the sea for the time being, a job done for the most part with sandbags. The river boards, augmented by over a hundred engineers from other parts of the country, undertook this unprecedented task, and they have since gone on to deal with the equally immense job of the permanent reinstatement of the defences. The river boards were formed under an Act of Parliament passed in 1948, and some of them had not come into being until the year before the disaster. That these new organizations, just settling down to their normal work, adapted themselves so quickly to the emergency, speaks very highly for the quality of their staffs.

The patchwork hastily put into place in a matter of days had to be strengthened as quickly as possible. Indeed, these stop-gaps were severely strained with each high tide, and the sandbagging was followed immediately by backing-up with soil dug by machinery from behind the banks. Some of the strengthening was done by driving temporary walls of steel sheet piles. At this stage engineering contractors began to take over much of the work. With an eye to the permanent reinstatement and improvement of the defences, a panel of consulting engineers and contractors was formed and arrange-

ments quickly made to get sound contract agreements with the least delay. Such was the co-operation of the industry and everybody concerned, that negotiations which often take weeks and months were completed in days, and the work itself was hastened correspondingly. By about the middle of March the temporary work was finished and attention could be turned to permanent reinstatement.

Restoration has generally produced banks that are thicker and stronger than they were before the floods—the mere fact that very often the old wall has been replaced has ensured this—but in a number of cases it was considered necessary, without waiting for the results of careful research, to raise the walls above their former height. For instance, at Canvey Island, where loss of life was most severe, the walls have been given three feet of freeboard above the storm level in the residential area and two feet elsewhere.

Watch and Ward The reasons for storm surges in the North Sea are not fully understood; neither do we know with certainty how often they are likely to occur. It has been suggested that a storm like that of January 1953 might occur once in about 150 years, but even if this turned out to be true, there is no guarantee that another will not occur in, say, fifty years' time. With this and other problems in mind, shortly after the disaster the Government set up a Committee under the chairmanship of Viscount Waverley, one of whose terms of reference was to consider the margin of safety for sea defences, having regard to risks and costs. The Committee's report, which is expected about Easter, will give guidance on this point, but further research will almost undoubtedly be necessary. In the meantime, the river boards, in consultation with the Ministry of Agriculture, have had to fix levels in the light of information at present available. A particular instance of this problem occurs where concrete walls have been built. As the photographs in the art inset show, it would not have been practicable to build them to an intermediate height and raise them later.

The Waverley Committee was also asked to consider and make recommendations for a warning system, and this it did in an interim report published in July 1953—in time for the high seas of the winter. The warning system which was evolved in accordance with these recommendations was introduced in September 1953, and is not dissimilar to the emergency system set up a fortnight after the floods and operated by the Ministry of Agriculture with the help and advice of the Tidal Branch of the Admiralty and the Meteorological Office. At that time, a twenty-four hour watch was kept in London during the spring tides for two periods of a week in each month until April. From April until the permanent system started, and in the intervals between spring tides, a secondary warning system operated, and members of the Ministry's staff were available night and day. The warning organization is now based on the Meteorological Office at Dunstable, Bedfordshire, and operates continuously from mid-September until the end of April.

By far the greater part of the sea defences of the East Coast consists of clay banks, and where the raising of their height has been under consideration, it has been discovered that in many places they become so heavy that they sink into the soft marshland on which they stand. Research is going on into means of solving this problem economically. The defences at Canvey Island are clay walls, and the extra height already referred to has been obtained by driving a fence of steel sheet piles into the top of the bank. The length of earth banks in Essex has been shortened in many cases by building dams across the creeks. Between Birchington and Reculver in Kent, and in Lincolnshire, where a medieval (and misnamed) "Roman" bank runs

parallel with the coast, the river boards have put two lines of defence—both earthworks—which will take the flood water if the sea walls fail.

Long stretches of the coast between the Humber and the Wash, in Northumberland and in parts of Norfolk and Kent, consisted of sand dunes, in some instances standing alone and in others faced by concrete work or reinforced with a clay bank. These defences are normally strong enough to keep out the sea and, although the sand dunes are constantly shifting, they are replenished as fast as they are eroded. But the storm last January removed so much sand that even where the dunes were not washed away completely, they were often too thin to make a safe defence, and it would have taken a very long time to replenish them naturally. In these places new walls of reinforced concrete founded on steel piles have been built, as shown in the illustrations.

The Cost So far, £20 million has been spent on the new defences. It has involved the moving of well over 10 million cubic yards of soil—enough to cover Hyde Park to a depth of about 18 feet—the placing of 5 million blocks to face the sea walls, and the use of more than 1,000 excavators and bulldozers. In addition to paying for the whole of the emergency and permanent restoration work, the Exchequer is providing 85 per cent of the cost of the improvements, and its share in the total expenditure of £24 million to which the river boards are at present committed is likely to be £22½ million. Special grants of 75 per cent of the cost have also been given for farm drainage to help in getting rid of the salt in the soil, and schemes of this sort have been approved for 50,000 acres of land. Acreage payments for the rehabilitation of agricultural land are being made, varying from £4 to £80 an acre. About £1,350,000 was paid out under this scheme last year, and it is expected that about the same amount will be spent in 1954. To assist in eliminating salt from the soil, 115,000 tons of gypsum have also been distributed free to farmers at a cost of £380,000. The N.A.A.S., too, is assisting by analysing soils. Over 20,000 salt determinations were made last year and a similar number is expected in 1954.

For the future it seems unlikely that man can guard completely against the worst that nature can do. But we are already better protected than we were in January 1953, and the work of improvement continues. The warning system recommended by the Waverley Committee is working and should minimize the danger to life. There is a standing organization for military assistance. We wait with interest to see whether research can provide sufficient knowledge of the problems involved—meteorological, hydrographic, engineering and administrative—to allow even further improvements.

National Institute of Agricultural Engineering

OPEN DAYS

The National Institute of Agricultural Engineering will be open for inspection by visitors from 10 a.m. to 5 p.m. on May 26 and 27. As in 1952—the last occasion when the Institute was open to the public—the emphasis will be on current research, development and testing in the sphere of agricultural and horticultural engineering. The various exhibits and illustrated techniques should therefore be of interest to farmers, growers and manufacturers.

BRUSSELS SPROUTS ON THE COTSWOLDS

R. C. TWYMAN, N.D.H.

National Agricultural Advisory Service, South-Western Province

Every year some 3,500 acres of Brussels sprouts are grown on the shallow, exposed soils of the Cotswold Hills. The story of this thriving and specialized industry is told here by Mr. Twyman.

THE Cotswold Hills, which were once the centre of a very thriving sheep and wool industry, are now proving equally suited to the growing of Brussels sprouts. For out of the 4,581 acres devoted to this crop in Gloucestershire, more than three-quarters of the acreage lies on the hills in the triangle formed by Chipping Campden, a small town bordering on Warwickshire at the northern end of the Cotswolds, Burford, adjoining Oxfordshire on the eastern boundary, and Andoversford, a small village five miles to the south-east of Cheltenham—in all, an area of approximately 20 square miles. The hills range in height from 400 to 850 feet, and only those who live on them know how bleak and exposed they are. The average annual rainfall is 25–27 inches, 10 inches of which fall between the months of April and September. The soil is shallow, comprising limestone over brash, and is known as the Sherborne series. This is a complete contrast to the soils below the hills, which are for the most part deep and on the heavy side, with a predominence of clay in them. In spite of its shallow nature, however, the soil retains moisture remarkably well, and it is amazing how the sprout plants ramify their roots between the brash to obtain the firm anchorage which is so essential on these windswept hills.

Although there are very large acreages of sprouts grown below these hills and in the Evesham Vale, it is generally accepted by all concerned that the quality is not equal to those produced on the Cotswold hill farms. This is proved by the demand from the markets, and by the increasing number of sprout growers seeking land on the hills.

The first record of Brussels sprouts being grown commercially on the Cotswolds goes back to the early part of the century, when a well-known market gardener from Mickleton planted a small area above Chipping Campden against the advice of other growers, who considered that the soil was too shallow and therefore unsuited for the crop. It was the general belief in those days that sprouts must have a deep, rich soil. Although the critics were proved wrong, it was not until after the First World War that other growers followed suit, and the acreage increased very slowly until the early 1930s. Since then it has risen steadily, and Brussels sprouts may now be seen growing in large or small acreages on 75 per cent of the Cotswold hill farms. The influx of growers from the Vale of Evesham and from the market gardens below the hills to the farms on the Cotswolds, which has been taking place gradually over the last twenty-five years or so, has only been made possible by the co-operation of the hill farmers in renting parts of their land. On the other hand, it should be borne in mind that the introduction of sprouts on to the Cotswold farms has been of considerable benefit to the farmers inasmuch as it fits in very well with their crop rotation: excellent crops of barley and other cereals are grown afterwards.

It is customary for agreements to be drawn up between the farmers and the sprout growers on the basis of a yearly tenancy (usually terminating on March 1), and it is so arranged that several years elapse before sprouts are again planted on the same land. The rent varies from £15 to £20 per acre

per year, and for this the farmer ploughs and cultivates the land and, in some cases, also applies the manure supplied to him by the sprout grower. When everything is ready for putting out the plants, the sprout grower takes over. It is usual for sprouts to follow a cereal crop, although occasionally they are planted after a short-term or three-year ley.

Manuring and Propagation The manuring programme generally involves first a base fertilizer, which is made up by the merchants to the grower's specifications, usually in the proportion of 6 parts nitrogen, 8 parts phosphates, 4 parts potash, and 2 parts bonemeal, and applied at the rate of 10 cwt. per acre when preparing the land for planting in March. This is followed by one or two top dressings of nitrate of potash during the growing season at the rate of 2 cwt. per acre. Great care is taken not to overdo the nitrogen for fear of forcing the growth too rapidly—a practice which invariably leads to loose, open sprouts. Lime is applied in the form of ground limestone at intervals of five years or so at the rate of 30 cwt. per acre, in spite of the fact that in most cases the soil analysis shows a high proportion of free lime, with a *p*H of at least 7.0.

Three main methods of propagation are used by the Cotswold growers. In the first, seed is sown on a carefully prepared seedbed in drills 9 inches apart in the open ground during the last week of August and first week of September. The seed is sown very thinly, since it is essential to produce sturdy, compact plants if they are to be overwintered successfully. Even so, losses are sometimes heavy. The second method entails sowing seed in cold glasshouses during the latter half of November in prepared beds 4 feet wide, and in rows 1½ inches apart. The resultant seedlings are thinned out so that they stand at 1½ inches square, and the thinnings are pricked out into other beds in a similar manner. A few growers pot up some of the seedlings into 3-inch clay pots and overwinter under glass. It is maintained that plants grown in this way do not receive a check when planted out, and consequently give an increased yield of up to 10 cwt. per acre. In both cases the plants are ready for putting out into their permanent quarters during March and April. Finally, seed is sown in the open ground during February and March to produce plants to follow those raised and overwintered out of doors or under glass.

The second and third methods are the most widely adopted. Plants from these sowings will give a succession of sprouts over a period of at least seven months of the year.

The big growers have their own favourite strains of sprouts from which they select plants with the desired qualities to grow on for seed purposes. Most of these apparently originate from the popular and well-known R. R. Smith strain, which has been maintained by careful selection by this grower since the early 1930s. Some idea of the value attached to this particular strain can be gained from the fact that, even in those early days, when ordinary Brussels sprout seed was selling at 20s. per lb. or less, R. R. Smith was offered £5 per lb. for his seed and has never sold any below 30s. Other varieties and strains, including the Cambridge seedlings, have been tried, but they have not been found equal to the existing strains for growing on the Cotswolds.

The method adopted by growers who save their own seed is to walk the fields of growing sprouts during the late autumn, selecting and marking those with the desired qualities. Approximately two-thirds of the sprouts are removed from the selected plants during the course of picking, and then in

February the plants are lifted and planted 2 feet apart in a corner or spare piece of ground in isolation, where they can be watched and protected from birds if necessary. During the autumn the stems are cut, tied into bundles and dried, before being stacked for threshing when required.

Planting, Cultivation and Management Planting is carried out by hand after the fields have first been lined out both ways by horse- or tractor-drawn markers, which mark four rows at once. Transplanters have been tried but they have not been very successful, owing to the undulating ground and rocky nature of the soil. Losses to rooks and rabbits are high. At least one gapping-up is necessary, and as many as 1,000 plants per acre have to be allowed for this purpose some years.

Planting on the square allows cultivation to be carried out in both directions, either by horse- or tractor-drawn implements, at intervals during the summer months. Hand-hoeing is also done when necessary.

Much of the work entailed in growing this crop is paid for on a piece-work basis as follows:

Planting	7s. per 1,000 plants
Hoeing	£1 10s.—£2 5s. per acre
Picking	1s.—1s. 3d. per net of 20 lb.
Cost of plants	£1 7s. per 1,000 plants (glasshouse); £1 per 1,000 plants (others)

The plants are stopped from mid-August onwards, according to whether they are planted early or late. This practice differs a little from that adopted in other counties, in that only the very centre of the growing point is removed and discarded; in many other parts of the country a large proportion of the tops is cut and marketed as greens.

Picking begins on a small scale in mid-August from the autumn- and glasshouse-raised plants and continues until mid-March, the peak pickings taking place during November and December. The growers endeavour to employ sufficient labour to allow for picking over once a month, and it is usual for the crop to be cleared in four operations. The more experienced workmen pick fifty or more nets per day, and thus get a very good living. Nevertheless, the money is well earned, since they work in all weathers; and on the Cotswolds the winter can be very severe indeed! The sprouts are graded for quality by the pickers as they work, but not for size. Loose and discoloured sprouts are discarded, and it is also customary to remove the lower leaves from the stems as picking proceeds.

Each worker has a numbered label which is attached to his net, thus enabling the grower to trace any complaints back to the picker responsible. It is very rarely that this happens with the better growers, as the men realize that their wages depend on the returns received. Accordingly, the sprouts marketed from the Cotswolds are, for the most part, of a very high standard. I regret to say that this does not always apply to the farmers who have taken up sprout growing without the necessary knowledge and experience, for they do not realize the amount and type of labour required in growing what appears to be a comparatively easy crop, and it is usually from this type of grower that the poor quality or badly-graded sprouts are marketed. To avoid this difficulty, some of them now plant and grow sprouts for auctioning as a growing crop during August. Here again, demands and prices fluctuate considerably from year to year, and I have seen them sold for as little as £20 and as much as £100 per acre.

As soon as the sprouts have been picked, the fields are handed back to the farmers who, in the majority of cases, fold off the residue with sheep, after which excellent barley crops are grown; in other instances the stems may be cut by rotary cultivator and ploughed under. A few growers still resort to digging up the stumps by hand—a slow and laborious task in these days of mechanization—after which they are carted off and dumped in odd corners. This, however, is a bad practice, for such heaps make ideal breeding grounds for aphids.

Although yields vary slightly according to the season, the average is 3½ tons per acre (equal to 392 nets). Much higher yields are obtained by the very best growers; for instance, one grower obtained 490, 500 and 567 nets per acre in the three years 1950–52. The nets are weighed and sealed in the fields, and then go to most of the leading markets by road and rail.

Pests and Diseases Measures have to be taken in most years against the Cabbage aphid (*Brevicoryne brassicae*). As a control the majority of growers have the plants sprayed during August and September with a systemic insecticide, which is proving most effective in eliminating the aphid, although there is some concern among growers over the very poisonous nature and persistence of the insecticide, which delays the picking from sprayed plants for a period of at least six weeks. But they have no alternative until something equally effective is discovered. It is very noticeable that the quality and cleanliness of the sprouts have improved tremendously since the introduction of this material. Nicotine and derris have been widely used in the past, but even under ideal conditions they were never so effective as the systemics. The spraying is carried out by contractors who have the necessary type of machinery and are fully conversant with the regulations appertaining to the use of poisonous sprays.

The larvae of the Cabbage Root fly (*Erioischia brassicae*) has not as yet proved a major problem and no control measures are taken, apart from treating the seedbeds with calomel. Ring Spot (*Mycosphaerella brassicicola*), which makes its appearance occasionally, is usually associated with unbalanced feeding and wet, mild weather. Club Root (*Plasmodiophora brassicae*) is practically non-existent.

Perhaps one of the biggest headaches to the sprout grower has been the pigeons, which have increased very rapidly during the last few years. They now abound in the area and do an enormous amount of damage—so much so that in spite of the use of cartridge ropes in some cases it has become necessary to have a man constantly on guard with a gun (as in the cherry orchards) in addition to the organized A.E.C. shoots.

A List of Agricultural Publications

There is sure to be a warm welcome for the National Book League's new "Agriculture" Book List. Compiled by F. C. Hirst, F.L.A., the Librarian of the Ministry of Agriculture and Fisheries, it is designed primarily to meet the needs of students, farmers and general readers interested in rural life and farming practice. The list is selective and the majority of the titles are of post-war publications. A full list of the current numbers of the Ministry's Bulletins is also included.

Copies of the list may be obtained from the Cambridge University Press, Bentley House, 200 Euston Road, London, N.W.1, price 2s.

THE MANURING OF FRUIT

3. SOFT FRUIT

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This article, which completes the series by Mr. Dermott on fruit manuring, discusses briefly the manurial requirements of the commonly grown soft fruits and some of the mineral deficiency problems which may arise.

ALL the crops discussed here—namely, strawberries, black currants, raspberries, red currants and gooseberries—are very dependent on an adequate summer moisture supply for satisfactory growth and cropping, and thus a good supply of organic matter in the soil is of great importance. Before planting, every effort should be made to give a generous dressing of dung, shoddy, compost, etc.; alternatively, a green manure crop or temporary ley may be grown.

Soft fruit crops as a whole may have a higher requirement for phosphate than tree fruits, and any deficiency of phosphates and potash should be corrected before planting by broadcasting and working in 3–4 cwt. per acre of superphosphate and a similar amount of either sulphate or muriate of potash. It is well known that some soft fruits (notably red currants, gooseberries, raspberries, and possibly loganberries and blackberries) are intolerant of the chloride content of muriate of potash, and these crops should always be given potash in the form of sulphate. Red currants, for example, exhibit an edge scorch (distinguishable from potash deficiency by being reddish rather than ash grey in colour) if given heavy dressings of muriate of potash. Muriate of potash may be used for black currants and (in moderation) for strawberries.

Most soft fruits, with the possible exception of black currants, will tolerate acid soils, but here again soils can be too acid even for these crops. The strawberry variety Royal Sovereign, for example, exhibits a marked reddening of the veins in the leaf on strongly acid soils, often accompanied by poor growth and cropping. Acidity is not, however, the only cause of red veining, as this condition can also arise from an excess of zinc, which is sometimes found in areas where rubber scrap (which sometimes contains zinc compounds as "fillers") has been burnt, or under wire netting cages. Magnesium deficiency in gooseberries can also be severe on strongly acid soils. Dressings of lime, at two-thirds of the recommended lime requirement, should therefore be given to acid soils where the *p*H value is below 5.8 before planting soft fruits.

It is not usually necessary to take special precautions against magnesium deficiency, except where gooseberries are planted on magnesium-deficient soils.

Soft fruit bushes should be mulched for the first season or two after planting.

Some Specific Recommendations It is particularly important to give a dressing of good-quality dung before planting strawberries. It may be ploughed in or, better still, worked into the surface soil. A simple and satisfactory method of manuring established beds is to give 6–7 cwt. per acre of a good compound fertilizer, such as National Compound Fertilizer No. 1 (7 per cent nitrogen, 7 per cent phos-

phoric acid, 10½ per cent potash), in February or March. Care should be taken not to over-concentrate the fertilizer around the plants. A light dressing of a compound fertilizer is often given after picking, and many growers consider that this builds up the plants for next year's cropping. If the straw used for littering the crop is worked into the soil, then 2 cwt. sulphate of ammonia per acre should be applied to assist decomposition. Where the bed is cropped for several seasons, a further dressing of well-rotted farmyard manure may be given with advantage.

Black currants have a high requirement for nitrogen, and it is usually necessary to give some inorganic nitrogen, even if generous dressings of farmyard manure are available. For average conditions, where available phosphate and potash have been built up to a high level, and when farmyard manure is not given, suitable dressings of inorganic fertilizers are 5–8 cwt. per acre of sulphate of ammonia, 2 cwt. superphosphate and 1 cwt. muriate of potash.

Black currants, and occasionally other soft fruit crops, are sometimes continuously mulched with straw to conserve moisture. Rather heavier dressings of nitrogen should be given to prevent the decomposing straw depleting the soil of available nitrogen.

Both raspberries and red currants require fairly liberal dressings of potash in the form of sulphate. Excess of inorganic nitrogen is to be avoided, since it tends to give unduly vigorous growth and this may also be produced on some soils by dressings of farmyard manure. Light dressings of good-quality farmyard manure, supplemented by 1–2 cwt. per acre sulphate of potash, is a satisfactory manurial programme. If farmyard manure is not available, suitable dressings of inorganic fertilizers would be 2 cwt. superphosphate and 1 cwt. sulphate of potash per acre during the winter, followed by 2 cwt. sulphate of ammonia per acre in early spring.

Manuring for gooseberries is similar to that suggested for red currants and raspberries, and again excess of nitrogen is to be avoided. However, dessert gooseberries, such as Leveller, are maintained at a higher nitrogen level so that the berries grow larger.

Acute Mineral Deficiencies in Soft Fruits The only soft fruit in which magnesium deficiency is a common problem is the gooseberry, where it gives rise to a reddening of the edges of the leaves, subsequently fading to a yellow or cream. This condition may be treated by the same methods as suggested in Part 2 of this article for tree fruits. All the soft fruit crops may exhibit iron deficiency on soils with a high lime content, although strawberries are probably most susceptible. In the latter fruit, iron deficiency can often limit the useful life of the crop to about two seasons. Here again, there are marked varietal differences in susceptibility to this deficiency disorder, and in a small-scale trial carried out by P. H. Harding and the writer a number of commonly grown varieties appeared to fall into the three following fairly distinct groups:

1. Markedly susceptible to iron deficiency — Cambridge 422, Cambridge 448, Huxley, Madame Lefebvre.
2. Moderately resistant to iron deficiency — Bradley Cross, Matilda, Royal Sovereign.
3. Showing a fair degree of resistance to iron deficiency — Auchincruive Climax, Cambridge 257, Perle de Prague.

Circumstantial evidence indicates that strong runners are more resistant to iron deficiency than poorer planting material, possibly due to the larger reserve of iron which they contain. Unfortunately, there is at present no satisfactory method of curing iron deficiency in soft fruits, although new organic iron compounds may eventually prove of value.

Manganese deficiency is often seen in raspberries and, occasionally, in strawberries and black currants. It may be cured by spraying, as in the case of tree fruits.

SIR JAMES CAIRD AND THE LANDED INTEREST

NIGEL HARVEY, M.A., Q.A.L.A.S.

Few of his contemporaries were in a better position than Sir James Caird to survey the achievements of Victorian agriculture—the High Farming era. His book, *The Landed Interest and the Supply of Food*, lives today as a remarkably revealing and authoritative record of that age of prosperity and development.

JAMES CAIRD was born in 1816 and died, the knighted doyen of British agriculture, in 1892. His active life, therefore, spanned the rise, fulfilment and collapse of the "High Farming", which was in its day one of the industrial wonders of the world, for it had raised the art and science of food production to a standard never before seen among men. And few contemporaries saw more of this classical system of farming than he did. As a farmer, he was at various times in his career a hired manager, a tenant and an owner-occupier; as a representative of *The Times*, he compiled one of the most balanced of that remarkable series of individual surveys of English agriculture which began with Arthur Young and ended with Daniel Hall; as a politician, he was mainly responsible for the introduction of the Agricultural Returns; and as an administrator, he served for nearly thirty years as an Enclosure Commissioner, besides undertaking certain official missions in Ireland and India. He was, indeed, one of the most vigorous and versatile representatives of a singularly vigorous and versatile rural age.

It was, therefore, a more than fortunate chance which compelled him to place on permanent record his considered appreciation of the farming industry he knew so well. For when the R.A.S.E. chose him to address an international conference of agriculturists, they inspired that major contribution to our farming literature, *The Landed Interest and the Supply of Food*, which was published in 1878 and portrays the High Farming in its full pride and prosperity, as it was at its climax, on the eve of the great depression that destroyed it. This circumstance gives the book its peculiar historical interest. But its character also gives it a contemporary importance. For, dazzled by the technical development of agriculture in the last decade, we moderns sometimes forget the less spectacular importance of the physical framework within which the farmer lives, moves and has his industrial being. There is more to farming than crops and stock, and it is the special virtue of Caird that he concerned himself so thoughtfully with the capital equipment of the land and the men who served it.

In style, this book is clear and pleasant; in argument, informed and convincing. Caird wrote, not without reason, as one having authority. But a certain confusion in his general presentation reflects the difficulties of his choice of subject; this is not really one book, it is two books in one cover, the first on the landed interest, the second on the national food supply. And it was no coincidence that he reversed the order of his title and dealt in his opening chapters with the supply of food. For it is only in superficial retrospect that the 1870s appear so peaceful a period of agricultural history, midway between the "heroic age" of the New Farming and the pressures of today.

In reality, Caird and his generation saw the collapse of the economic assumptions in which they had been bred, and they faced a problem hitherto unknown in our country. Population, particularly urban population, was increasing; in the previous thirty years the population of England and Wales had risen from eighteen million to twenty-four million, the proportion of town dwellers from a half to two-thirds. So, too, were the standards of living rising. In the 1840s, said Caird, perhaps one Englishman in three ate animal food more than once a week; but in the 1870s there were few who did not eat butter, cheese or meat at least once a day. Never before had so many people in these islands demanded so much food. Never before had they been prepared to pay so well for it.

Such an incentive was, it is true, nothing new in principle. The same sort of challenge had inspired the Agricultural Revolution a century before. But whereas the hunger of the population was increasing and indefinite, the land whose produce was traditionally the sole method of satisfying it was limited. The men of George III's time had asked and, to their satisfaction, answered the question: "How does the English farmer propose to feed the English people?" Their grandsons put the same question in a rather different form: "How are the English people going to be fed?" The change of emphasis was significant. In Caird's day, this country was beginning, for the first time in its history, to consume more food than it was prepared to produce.

Three Sources of Extra Food Caird, therefore, began his book with an analysis of the three sources from which, in the previous generation, Englishmen derived their increasing supply of food. First, of course, there was reclamation—the "winning of the waste"—which had been one of the greatest themes of our rural history since Saxon times. Between 1867 and 1878, he said, the area of permanent pasture in England and Wales had increased slightly, but the acreage of corn had not decreased. Clearly there was still farmland to be redeemed from hill and marsh. But equally clearly this ancient means of increasing food production was now failing. It was, after all, half a century since the Duke of Portland had carried his famous irrigation scheme into the heart of the Nottinghamshire sands and John Knight had begun his epic attack on the Exmoor desolation. The very physical extremity over which these men triumphed showed that, even in their time, little of primeval England was left for the farmer. The reclaimer, in fact, had almost worked himself out of his job. On the whole, concluded Caird, further reclamation would require capital which could be more profitably invested elsewhere.

The second source of increased production was greater efficiency on the farm—better methods instead of more acres. But the early technical impetus of the Agricultural Revolution was now spent, and in Caird's time the steady diffusion of existing knowledge and proved practices was more

obvious than new invention. Consolidation rather than dramatic development was the order of the day. It was, for instance, significant that the greatest single contribution to increased productivity in mid-Victorian times came from an early Victorian tool—the tile-pipe—which was first mass-produced in the 1840s. Since then, it was true, reaping machines and steam engines had established themselves on the farm, but these decreased human and animal labour rather than they directly increased production, while the new chemical fertilizers were still of secondary importance. Time had falsified the confident hopes of such New Farming enthusiasts as Mechi and Smith of Deanston, who in a previous generation had prophesied that when the full promise of agricultural improvement was fulfilled Britain would once more turn food exporter. The men of the 1870s necessarily took a more sober view, and Caird therefore discussed at some length the third and less precedented source of the Englishman's food—the overseas farm. Between 1857 and 1876, he said, the value of food imported into this country had trebled, and by the latter year no less than half our bread-corn and a quarter of our meat came from abroad. Some contemporaries, indeed, foresaw danger for the home producer in this startling new trend, but Caird himself felt no such fears; Britain might be a free trade country, but the expense of transport necessarily gave the English farmer a high degree of "natural protection". The British market was open to all and there was no particular reason why the British farmer should not continue to enjoy the lion's share of it.

The Prosperous Landowner Such was the general background to the "Landed Interest" which Caird then analysed in detail. Of farmers and farm labourers, he says little; his concern was not the national farm but the national estate. And the central figure of the national estate was unquestionably the private landlord who owned and equipped the soil which others cultivated. For in Caird's time the owner-occupier was a rarity, and even the farms-in-hand on the larger estates provided their owners with enjoyment and domestic supplies rather than commercial profits. Great, indeed, was the wealth, great the power of the Victorian landlords, owners of "a limited article, allowing no increase of size, for whose produce there was an ever-increasing demand". Hence, for instance, a rise of some 20 per cent in rents which had taken place since the later 1850s. Hence, too, the considered opinion of a Committee of the House of Lords in 1873 that expenditure on the capital equipment of farmers was perhaps the most profitable of all forms of investment. Not, of course, that the land offered easy money. Cottages, ominously for the future, were seldom remunerative—they cost £150 apiece, but in few districts could the labourer pay even half the 4s. a week required to make them an economic proposition—and Caird wrily recalled the huge corn barns of an earlier age rendered obsolete only a generation previously by the coming of mechanical threshing. Indeed, in those days of cheap labour farm buildings were inclined to be an uncertain form of investment "unless the money was carefully and wisely spent". But these were minor dangers, minor risks, and in Caird's day the managing director of an agricultural credit corporation, taking forty cases at random from his records, found that the expenditure showed an average yield of 15 per cent. The Victorian land, therefore, offered its owners good returns as well as good security.

This was, indeed, the Golden Age of the private landowners. "No other body of men in the Kingdom," Caird truly remarked, "administer so large a capital on their own account or enjoy an influence so widely extended

and so universally present". But he also noted that certain of the old traditions were weakening. Prosperity was proving a poorer incentive than the bitter demands of Napoleonic times. "The landowner himself," he wrote, "too seldom takes the active and intelligent interest in the details of management as would convince him of the need to keep his farms in a state of high working order". The same general tendency was reflected in his definition of the land-agent's duties. "Transacting business with the farmers and looking after the cultivations, buildings and the general condition of the property" would have seemed painfully incomplete and unenterprising terms of reference to such men as Blaikie, Salmon and Loudon, who served the "improving landlords" of the Agricultural Revolution half a century earlier.

Neither had the passing of time removed the great theoretical defect of the landlord-and-tenant system, for most English tenancies could still be terminated at six months' notice. In practice, admittedly, habit and custom gave more than reasonable security, and there were many tenants-at-will who counted their family occupation of their farms not in years but in generations. Nevertheless, the legal weakness remained and Caird might well have strengthened his criticism by quoting his earlier praise of the famous Coke, whose long and generous leases so encouraged his tenants to improve their farms to the mutual advantage of all concerned.

The place of the State in the mid-Victorian farming system provided an interesting commentary on the power and responsibilities of the contemporary landowners. It was, indeed, best defined in a series of negatives. There was in this country, said Caird, no Ministry of Agriculture, there were no State flocks or herds, and no State schools of agriculture. The only department directly concerned with land management was the Inclosure Office, and even that could only act on the initiative of private individuals who sought means of facilitating improvements. The enclosures themselves were now a minor matter, but the Office administered certain Drainage and Improvement Acts and also acted as agent and arbitrator for the exchange and partition of land, thus enabling landowners to correct irregularities in the boundaries of their estates and even exchange whole properties. This was probably the most valuable of all the Office's functions, and some 6,000 to 10,000 acres changed hands annually under its aegis.

The Turning Tide Caird ended his book with the remark that our countryside was becoming "less and less of a farm and more of meadow, a garden and a playground". The future, in its sardonic way, was to prove him a better prophet than he ever knew. For the cloud no bigger than a man's hand which he noted on the economic horizon soon turned to a driving rain which swept away the farming system he knew and served. In the twenty years after the publication of his book, the overseas producer turned from ally to competitor, from competitor to conqueror. What Caird saw in a green tree, therefore, Rider Haggard saw when the wood was dry. The falling arable acreage, the spread of grassland, the increased use of the countryside for the townsman's recreation—all these came in a form more violent and more drastic than anything Caird had ever imagined. And as the High Farming went down, hopelessly defeated, into history, *The Landed Interest and the Supply of Food* exchanged its contemporary value for a more permanent place among the economic classics of our rural literature.

THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the December 1953 issue of AGRICULTURE (p. 440), the undermentioned publications have been issued.

MAJOR PUBLICATIONS *Copies are obtainable, at the prices quoted, from the Sale Offices of H.M. Stationery Office or through any bookseller.*

Bulletins

No. 134 Honey from Hive to Market (*New*). 2s. 0d. (2s. 1½d. by post)
No. 158 Breeding for Bacon Production (*New*). 1s. 9d. (1s. 10½d. by post)

Other Publications

Diseases and Pests on Horticultural Planting Material (*New*). 6s. 0d. (6s. 2d. by post)
Agriculture Act 1947 and Agricultural Holdings Act 1948: Rights and Obligations of Landlords, Tenants and Owner-occupiers of Agricultural Land. (*Revised*). 1s. 3d. (1s. 4½d. by post)
Co-operative Farms with Centralised Services in Wales: Reports and Accounts 1951-52 (*New*). 2s. 0d. (2s. 1½d. by post)

LEAFLETS *Up to six single copies of Advisory and Animal Health leaflets may be obtained free on application to the Ministry (Publications), 19 Chester Terrace, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from the Sale Offices of H.M. Stationery Office.*

Advisory Leaflets

No. 51 Thistles and their Control (*Revised*)
No. 206 Rhododendron Bug (*Revised*)
No. 284 Potato Root Eelworm (*Revised*)
No. 385 Machine Milking (*New*)
No. 388 Home-grown Linseed (*New*)
No. 407 Cowshed Hygiene (*New*)
No. 416 Farm Dairy Hygiene (*New*)
No. 417 Poultry Pedigree Recording (*New*)
No. 418 Antibiotics in Livestock Feeding (*New*)

Animal Health Leaflets

No. 2 Coccidiosis in Chickens (*Revised*)
No. 13 Salmonella Infection of Poultry (*Revised*)
No. 14 "Husk" or "Hoose" in Calves (*Revised*)

FREE ISSUES *Obtainable only from the Ministry (Publications), 19 Chester Terrace, Regent's Park, London, N.W.1.*

Growmore Leaflets

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No. 105 Cabbages and Related Crops (*Revised*)
No. 107 Winter Root Crops for the Garden (*Revised*)
No. 109 Pig Weighing (*New*)

Farming Topics

No. 1 Saving Labour
No. 2 Care of Combined Grain
No. 3 More Grass from Fewer Acres
No. 4 Quality Baconers
No. 5 Sound Rotations
No. 6 Running Repairs to Farm Buildings

Other Leaflets

Subsidy for Fertilizers (*New*)
Grants for Ploughing Grassland (*New*)

FARMING AFFAIRS

Electricity on the Farm The great demand for talks of a really practical nature was demonstrated in Cambridge recently when 500 East Anglian farmers spent a profitable day at an Agricultural Land Service meeting to study problems connected with simple building work by farm labour. This event, the first of its kind organized by the Advisory Services, Eastern Province in conjunction with the N.F.U., had for its theme "How to do it, and what faults to avoid". Referring to the type of electrical work which could safely be undertaken by unskilled labour, R. V. RICHARDSON, Eastern Electricity Board, strongly advised consultations between the farmer and a qualified contractor if any doubt arose regarding the efficiency of an amateur installation. It was much better to ensure a satisfactory standard of safety and efficiency by having fixed wiring installations carried out by qualified electricians in accordance with the regulations issued by the Institution of Electrical Engineers.

"Installations undertaken by farm labour may cancel existing insurance policies" said Mr. Richardson, "and Fire Insurance Companies are not prepared to accept any risks unless the work has been approved by a recognized contractor or the Electricity Board."

Jobs of a minor character, however, are well within the scope of a handyman, and switches and socket outlets could be connected for plugging in additional equipment in farmhouses and buildings. To ensure safety, even when changing a lamp, care should be taken to switch *off*, and work should never be started on a live circuit.

Three-pin plug tops are best, and flexible three-core cable designed for the job should be used. "When you bare back the tough rubber outer case of the cable," said Mr. Richardson, "three separate cores, coloured, red, black, and green, are exposed. The green core is the earth wire and should be connected to the large plug pin, as it is this connection which will by-pass any possible leakage of current and afford protection both to the installation and the person using it. The red core is connected to the live pin (marked 'L'), and the black core to the second small pin marked 'N' for neutral."

Infra-red lamps are in general use in farm buildings today but, assuming the ordinary silver deflector type is installed, not more than eight lamps should be attached to any one circuit. Some serious accidents have occurred through handling these lamps, and to eliminate risks a shield-type of holder should be used.

Rural distribution is usually made on a single phase supply, which is also general practice in the U.S.A. and most of Europe. For industry, a three-phase installation is carried out as considerable power is needed, and this costs 25–30 per cent higher than for single phase. Over 90 per cent of all electrical motors on farms in this country are of less than 2 h.p., and a single-phase supply is usually quite adequate.

Discussing the prospects for rural electrification, Mr. Richardson said they were better than ever before. In the Eastern Electricity Board Fen sub-area which consists of 1,300 sq. miles, a new scheme is under way in Huntingdonshire and another scheme is in course of preparation for the Ely fens. These examples are indications of the rapid progress being made all over the country. To reduce the cost of these schemes to a minimum, it is of great assistance if all farmers in the area agree to take a supply. "If you send in

an application tomorrow," said Mr. Richardson, "don't expect to have an installation next week, since the planning takes 9–12 months. We are, however, pressing ahead fast, and I assure you that rural electrification is receiving top priority."

W. J. S. Fordyce

A Buyers' Market in Milk During the last fifteen years the main concern of the milk industry has been to provide enough liquid milk and milk products to meet the demand, and there has been little scope for non-essentials. This sellers' market has unfortunately led to the development of fixed ideas and habits among producers, distributors and housewives alike, so that the change to an unrestricted buyers' market which is now coming about poses many problems. Since in N. America the sellers' market in milk disappeared long ago, it is pertinent to ask if we can learn anything from American methods of handling, distributing and presenting milk products in time of surplus.

The great prosperity of the United States and Canada has been reflected in the high consumption of food, but even so, surpluses have appeared. It is true that the increased yield per cow has contributed in part to this surplus in the case of dairy products, but a much more significant feature is a discernible falling off in the demand for dairy foods—now at a lower level than before the war. American tastes, it would seem, are changing. This is seen in the consumption of butter, which in the U.S.A. in 1939 was 17.2 lb. per head. Today it is barely half that figure. Instead, the American has turned to margarine at only half the price. As a direct result, over 4½ million cows, whose milk once went for home butter-making, are now producing for export only. The only really startling increase in sales of milk products in either the U.S.A. or Canada has been in ice cream; the 1952 figures show the yearly consumption in the U.S.A. to be 17½ lb. per head!

In both the U.S.A. and Canada the situation is being met by increased publicity and advertising urging the public to buy more milk and dairy products (in 1952 £3 million was voluntarily contributed by distributors and manufacturers in the U.S.A. for this purpose), and by extending the range of attractively presented products offered to the consumer. Thus dairymen are now carrying many different grades and types of milk, including homogenized, which is very much in demand in the big cities. Skim, or 2 per cent, milk is also popular, especially in the Eastern States, though possibly this demand is fostered by the diet-consciousness of many Americans. Whatever the cause of its popularity, skim milk sells at only three cents a quart below the normal price. Chocolate milk drinks, cottage cream (a very popular dish in both vegetable and fruit salads), buttermilk, ice cream, and two or three grades of cream are all offered by the dairyman. There is a particular demand for the so-called "coffee cream"—a 12 per cent cream which, as the name implies, is widely used in coffee. It is, in fact, sold in far larger quantities than the 40 per cent whipped cream that we know.

Another lesson that the American practice must bring home to our distributive trade is that to sell well milk must be fresh and cold. Of course, in America refrigerators exist in nearly every shop and home, and the system of tank collection from farms is on the increase.

These are some of the features of the American dairying industry which struck a small delegation from the Milk Marketing Board which visited the U.S.A. last year. Not all the American ideas are applicable here—there is

no doubt many of us would be shocked by some of the expensive machinery which they have thought fit to install in the interests of labour-saving—but they do offer a lead to the industry in its new task of *selling* milk to the public. It is now up to the manufacturers, distributors and dairymen to see how they can make the British public more milk-conscious.

Farming Cameo: 39. Exeter The Exeter district in east Devon is roughly bisected by the River Exe and its estuary, and stretches along the coast from Sidmouth to Teignmouth. From Teignmouth the boundary runs in a north-westerly direction along the Haldon Hills to the edge of Dartmoor, some 20 miles inland, thus forming a belt of land about 15 miles wide, with the city of Exeter—the most important market in the county—as the administrative centre. The land within this belt, which includes some 131,000 acres devoted to agriculture, ranges from 30 feet above sea level to over 1,000 feet, and is subject to an annual rainfall varying from 30 inches near the Exe estuary to 40 inches or more on the highest land. The River Exe and its more important tributaries, the Yeo, Creedy, Culm and Clyst, form a fan-like network in the area.

Within the district there is a wide variety of geological formations, the most important being alluvium, valley gravels, red marls and sandstones of the New Red Sandstone series, shales and grits of the Culm Measures, and igneous rocks, mainly of granite and basalt. Thus the soils range from light sands at Dawlish and Harpford, through the pebble beds at Woodbury and the vivid red sandstone soils at Kennford, to the more or less heavy soils of the Culm Measures south of the Creedy Valley. The latter are usually of a yellowish-grey or buff colour, almost invariably deficient in lime and phosphates. They are capable of growing fairly good grass, but they never reach the fertility of the red marls, either as pasture or arable land. The low-lying tract of alluvial land south of, and adjacent to, the River Exe between Exeter and Powderham, is known as Exminster Marshes. This forms an important area of grazing land carrying large numbers of fattening stock during the summer months. By contrast, the poor flint soils on the Haldon Hills have given rise to a saying in the county "as poor as Haldon". Much of this land, otherwise unsuited to agriculture, has been successfully afforested by the Forestry Commission.

Farms in the area vary greatly in size—from 5 acres on market-garden holdings to 600 acres—but by far the greatest number are less than 100 acres in extent and suited to family farming. Since the war many potential farmers have come into the county, and to this district in particular, with the result that land has changed hands at greatly inflated prices, and there has been considerable splitting of good farms into two or more holdings, at times without farmhouse and buildings. These holdings frequently tend to be uneconomic units on account of their size, steepness, or the inherent infertility of the soil.

A number of different types of farming are practised, from specialist flower- and fruit-growing and market gardening at Dawlish and Topsham, to dairying, arable farming and beef production. On many of the holdings that have by tradition been arable-beef farms there has been a definite swing during the past fifteen years towards dairying, but there now appears to be a slight, but nevertheless definite, revival of interest in beef fattening. Moreover, despite the increased emphasis on dairying, a recent survey of breeds of livestock within the district showed that there are more animals of the

North Devon breed than any other. Herds of Ayrshires and Friesians are, however, increasing. The total number of cattle of all breeds is 42,000.

The call for the ploughing up of grassland, the demand for more milk and an increase in the number of farmers who understand dairy cattle but not sheep, have tended to reduce the number of sheep kept, although recent high wool prices have brought signs of a revived interest. The sheep population is now about 48,000; the principal breeds are Devon Longwool, Devon Closewool, South Devon, Dartmoor, and crosses of these breeds with other pure breeds. Poultry has always been kept in small flocks on most of the farms, but in the last three or four years there has been a marked increase in poultry in batteries, deep litter houses, and hen-yards. Since the introduction of fodder beet, fresh interest has also been awakened in pig-keeping.

A. J. Brown,
District Advisory Officer

Wise Stock Feeding:
13. Precautions on Going out to Grass

It is only within the last twenty years that serious attention has been given to producing more and better grass from the pastures of this country. Better seeds mixtures, greater use of fertilizers and improved methods of management have resulted in substantial increases in the yield of grass produced per acre. But the proper utilization of this grass in general still leaves much to be desired, and in far too many instances the full potentialities of the grass crop are not appreciated. Particularly is this so in spring and early summer, when grass is in its most nutritious condition. Most farmers know that young grass stimulates and increases milk production, but not so many realize just how much spring and summer grass can contribute to livestock needs. In this young, leafy condition, grass may indeed be regarded as a concentrate foodstuff.

An average dairy cow will eat about 150 lb. of fresh grass daily. This amount of grass provides sufficient starch equivalent for the maintenance of the animal and at least three gallons of milk, and enough protein for maintenance and at least five gallons of milk. Cows producing up to three gallons of milk therefore require no supplementary concentrate feeding when grazing spring grass. An additional two gallons can be produced merely by allowing a further 8 lb. of starch concentrate food (oats, barley or dried sugar beet pulp), as the protein requirements are satisfied by the grass. On many occasions when cows are grazing spring grass, balanced concentrates are fed for every gallon, or for every gallon after the first, and valuable concentrated foodstuffs are thus wasted at a time when economies are both practical and desirable.

Not only is unnecessary concentrate feeding in spring wasteful, but in some ways it is also harmful. The tendency for butterfat levels to fall at this time of year is now well recognized. This tendency is accentuated by heavy concentrate feeding and by the absence of any long fibrous roughage, such as hay or straw, in the diet. Hay or straw (or both) should always be freely available on the pasture being grazed, and hay should be offered to the animals when they are yarded or stalled after milking and before turning back to grass. Although the animals will eat very little roughage when grass is so palatable and acceptable, the consumption of only a few pounds a day will help greatly in counteracting the fall in butterfat levels. Indeed, where no long roughage is available, the animals will often search for long fibrous roughages from the hedgerows. In contrast to the fall in butterfat levels, the level of solids-not-fat in milk tends to increase in spring.

Changes in feeding practice should be made gradually, and this maxim applies particularly to the change from winter to summer rations. Animals should be given short periods of grazing when first turned out, and the time allowed should be increased slowly, until the animals can be left at grass for long periods. Many cattle disorders occurring at this time are no doubt attributable to a too hasty change.

The electric fence can help greatly in the full utilization of the highly nutritious spring grass. Without some form of controlled grazing, much grass is trodden and poached, and a saving of up to 25 per cent can be effected by intelligent use of the electric fence.

Veterinary problems such as bloat and various other conditions associated with spring herbage are outside the scope of this note, but there is not doubt that correct feeding management helps to limit the incidence of these problems.

G. Thomas

Horticultural Careers of Nottingham Students In the November 1953 issue of AGRICULTURE, details were given of the careers of some three hundred and fifty students who had taken courses in agriculture and dairying at the University College of Wales, Aberystwyth. A similar survey is given below of the present employment of students who have taken horticultural courses since 1943 in the University of Nottingham Department of Horticulture.

	B.Sc.(Hort.) (since 1949)	Diploma in Horticulture
Working in Commercial Horticulture		
On own account	5	22
Managers or assistant managers	1	9
Employees in commercial holdings	13	30
Employees in Experimental Horticulture Stations	5	6
Working in "Amenity Horticulture"		
Private gardens	1	–
Botanic gardens and public parks	1	7
Gardening in schools (non-professional)	1	2
Landscape gardening (non-professional)	–	3
Floristry	–	1
Professional Appointments		
Research work	2	2
Landscape architecture	–	1
Local authorities	1	2
Institutes	2	4
Universities	2	1
School teaching (rural subjects)	4	5
N.A.A.S.	5	15
Horticulture Abroad		
With commercial undertakings	2	4
Colonial Service	6	–
Not Employed in Horticulture		
National service	7	7
Further training	1	4
Left Horticulture		
On marriage (women)	3	24
	62	149

FARMING AFFAIRS

Cobalt and Animal Health Our knowledge of the great importance of the so-called trace elements in the nutrition of stock is comparatively recent and still not complete. The commonest of these are boron, chlorine, cobalt, copper, fluorine, iodine, molybdenum, radium, selenium, zinc, and the most sought after metal in the world today—uranium. Too little or too much of any of them leads inevitably to malnutrition and the onset of disease. Thus a deficiency in copper in pastures on which sheep are run will induce "sway-back", lack of iodine in the soil will produce goitre, an excess of molybdenum, as in certain pastures of Somerset, causes a disease called "teart", whilst too great a proportion of selenium gives rise to a disease in cattle and horses which is characterized by abnormal growth of hoof and loss of hair.

The Mond Nickel Company's recently issued booklet* on the subject of cobalt in animal nutrition explains the value and importance of this particular trace element concisely and informatively. The author, Dr. W. M. McKay, M.C.R.V.S., draws attention to the insidious ills that may befall livestock exposed to the dangers of cobalt-deficient pastures: pine in sheep, and slow fever (ketosis) and malignant catarrh in cattle. He points, too, to the important association of cobalt with the vitamin B_{12} and its relation to the nutrition of pigs and poultry. Cobalt deficiencies can be overcome by top dressing the land concerned with cobalt sulphate and by treatment of the affected animals, after diagnosis, by drenching, pills, tablets, licks and mixtures.

BOOK REVIEWS

The Law of Agricultural Holdings (2nd Edition). W. S. SCAMMELL. Butterworth. 45s.

In its second edition this book has grown by 60 pages to a total of 602, although the general layout is little altered. All the excellent features of the first edition are retained, including the valuable plan of how the work is arranged. The paper and printing are again excellent and the cover is claimed to be more durable. The original cover was solid enough but "Scammell" has become such an authority that any cover is bound to wear through constant use, and an occasional blow with the book on counsel's table to drive home a point is not calculated to prolong its life!.

The new edition draws on the accumulated experience of the working of the Agriculture Act, 1947, and Agricultural Holdings Act, 1948, as they affect land tenure, and the author has himself played a conspicuous part both in advising and pleading. His book has appeared on statutory occasions before A.E.C.'s and land tribunals, as well as in the courts of law. It has been a most successful book and was quite original in its simple presentation of an incredibly complicated subject. The second edition is better than the first and will be assured of a wide demand; it cannot be the last of its line, but it was clearly necessary to strike a balance now and see how the acts are working in practice.

The author himself praises the dictum of a Lord Justice for being short and clear; but that is precisely the key to the merit of his own book. Although primarily a work of reference, it is readable as a book on its subject, and will therefore be especially welcomed by students. The working of acts are in the hands of owners, farmers and land agents on many important occasions, and it is, therefore, really essential to have a law book which ordinary, intelligent laymen can read with easy appreciation and profit. Yet the quality of the work and the professional standing of its author is so high that it is still likely to be banged about in court on many future occasions!

It can be warmly recommended to all those concerned with the fascinating subject of English land tenure and its present unique development.

R.G.A.L.

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* *The Application of Cobalt in Agriculture*, free from the Mond Nickel Co. Ltd., Sunderland House, Curzon Street, London, W.1.

BOOK REVIEWS

Farm Management. JAMES WYLLIE. Spon. 25*s*.

The study of farm management has been greatly neglected in this country, but now that efforts are being made on many sides to correct this deficiency, Mr. Wyllie's book could hardly have come more opportunely.

The author, a well-known expert on the subject, has consistently advocated the merits of cost accountancy analysis, and he follows this line in his book. He will have nothing to do with the conception of the "average farm". There is thus an emphasis throughout the book on the individual farm and on the individual farmer's problems. No attempt is made to use averages or the group approach in the solution of farm management problems. And the author's use of figures is sparing—a feature that will appeal to many readers who have no liking for the precision which their use demands. Here and there, though, a little more use of figures would have made the arguments easier to understand.

The chapters dealing with the more subjective aspects of this work, such as those on the qualifications of a farmer, application of economic laws in farm management, choice of farm and farming policy, have not the depth and breadth and sure grasp shown in later chapters, such as those on particular farm enterprises.

Something more convincing than is provided is needed on these questions. Surely the qualifications of a farmer is the heart of farm management. Farming policy and its moulding to meet economic stresses and strains is a most important question and is largely a matter of assessing future prospects in the industry or that part of it in which the particular farmer is interested.

Discussing measurements of efficiency, Mr. Wyllie brings out important points—one of them that the farmer is always part of the farm he is running. There is at least a two-way impact—farm on farmer, and farmer on farm. It is a difficult job to give the right emphasis to those things which matter most here, and the author warns rightly against resort to averages to resolve this difficult question. "Output per man" comes in for rough treatment as a measurement for efficiency. There can be no doubt that when it is used in the ways the author objects to, he is on sound ground. Nevertheless, this is a most important concept in the economics of agriculture, and Mr. Wyllie himself reprieves it later in his book.

The discussions on the various enterprises show a sure grasp of issues as they are inside the farm departments, and the keen farmer will be nodding agreement with the argument as he reads, and seeking information from records (where they exist) to help him answer questions which this book will raise in his mind.

Many farmers and advisory officers will read this book with interest and benefit. Students and others less experienced in farm organization and practical farm management are likely to find it difficult, for the author's approach is not that of the systematic pedagogue. It is rather that of the analyst who sees the industry as a living force which does not stop for analysts to make up their minds; rather the management decisions must be taken as it were "on the run". These decisions will be all the sounder when they are taken by managers who are well informed on essentials and who can cast out of their minds the irrelevant and the useless. Mr. Wyllie's book treats farm management as the dynamic thing it really is.

E.JJ.H.

Stock Husbandry. J. S. PATON PHILIP. Pitman. 21s.

Stock Husbandry is the third book in the publisher's Farm Institute Series, and deals with dairy and beef cattle, sheep, pigs, poultry and horses. For each species breeding, rearing, feeding and management are considered, and the wonder is that so much ground can be covered in such a short book. To read it is not only to appreciate the great value of farm institute training—for all the essentials are there—but also to realize the limitations of such short courses.

There are few, if any, statements made in this book to which definite exception can be taken, and yet there are very many which are subject to serious qualification. As a very simple example, the author states that "the average life of a dual-purpose cow is shorter than that of a cow of a true dairy breed". This is no doubt correct, but the reason surely is that there is generally more need for culling in the former group because of the double-breeding objective. Since space does not permit the author to explain this, the reader may be left with the impression that individuals of the dual-purpose breeds suffer in the matter of longevity—an impression that most people would regard as fallacious. A short book on the vast subject of stock husbandry must necessarily keep to the general rule and cannot deal with modifications; but they may be very important.

Mr. Paton Philip has nevertheless provided the basis of the subject in supremely succinct form. As an introduction to animal husbandry, the book is admirable, although the reader should be encouraged to pursue his studies in greater depth. The English is clear, smooth and unadorned and, in consequence, the book (which contains 35 illustrations and 17 tables) is very easy to read. It should receive a warm welcome from those for whom it was written.

H.G.S.

Wine Growing in England. GEORGE ORDISH. Hart-Davis. 7s. 6d.

The making of wine is a practice older than recorded history; the Egyptians attributed their knowledge of it to their god Osiris, the Greeks to Dionysus, the Hebrews to Noah. And since that time a very great deal, in prose, verse and song, has been written eulogizing the virtue of the grape. The chroniclers of the Bible, the classic writers of ancient Greece and Rome, philosophers of the East, poets of the West—all have made the subject of wine their common ground. Thus Omar Khayyám, who saw in it an essential constituent of Paradise, and Keats who sighed for :

. . . a draught of vintage that has been
Cooled a long age in the deep-delvèd earth.

To this jocund company comes Mr. George Ordish, sweeping away with a practical and practised hand the veils of mystery which tend, like cobwebs on old bottles, to obscure material that should be better known. Here, in England, where beer and cider have monopolized the field since the Middle Ages, we can, he asserts, grow good crops of grapes in the open and make as good wine from them as will satisfy the delicate palate of the connoisseur. The author has been growing grapes in his garden at Yalding in Kent for the past fifteen years and making some 50–60 gallons a year of excellent wine, most of it red and rather like a Bordeaux, for himself and his family.

His theory that a better-flavoured, if smaller, crop can be grown on the edge of the vine's climatic range is attractive. With our present varieties, he thinks good outdoor crops could be grown as far north as 53 degrees parallel, provided the sites are well chosen. Mr. Ordish mainly favours the variety *Brandt*, but there are a number of others.

The book clearly describes the culture of the vine and the skilled process of making the wine from the initial crushing and fermentation of the grapes to the final clarifying and bottling. Thereafter, it is a matter of resisting temptation. As the author shows, no expensive equipment is needed to embark on this fascinating hobby.

Mr. Ordish also considers briefly the possibilities that exist for the commercial production of wine in this country—wine that would not attempt to emulate Continental produce, but rather a *vin du pays* that would win a reputation by its own characteristics.

At a time when wine-drinking is becoming increasingly popular in Britain, this book comes most opportunely.

S.R.O'H.

Society and the Land. ROBERT TROW-SMITH. Cresset Press. 18s.

In his new book, Mr. Robert Trow-Smith deals with the history of the changing relationships between agriculture and the social life of Britain. His purpose is to record the development of food production from the time when it was the concern of nearly everyone in the country to produce a subsistence for himself and his family, to the days when the growth of mercantile and industrial elements in the population called on rural workers to produce surpluses for their support. And so he goes on to more recent times, when the question is to determine how much home food production is still necessary in the national economy of a people more than 90 per cent of whom are occupied in non-agricultural pursuits, and most of them selling home industrial products in the markets of food producers overseas. Today, perhaps a climax in the social and economic history of the nation has been reached, and once more an answer is being sought to the question: "How much agriculture can the country afford?"

The position first became acute towards the end of the last century, when steam transport by land and sea, and the invention of mechanical aids to farm labour, brought great areas of undeveloped land into cultivation in various parts of the world within reach of the British market. Then the general opinion of this country was that farming was just another industry which would have to contrive to justify itself amongst the rest. By a large measure of readjustment, it succeeded, and later the shock of near-starvation during the first world war seemed to invest home agriculture once more with a special claim upon

the nation's consideration. Not for long, however; and with financial support for the industry withdrawn almost as soon as promised, farming faced bankruptcy during the world economic crisis. But direct State aid to farmers was forthcoming, and as the new threat to world peace advanced over the horizon, a definite determination to stimulate the production of the main food staples was discernible in national policy. With the second war over, however, and some evidence of increasing freedom of exchange apparent again in world markets, the old problem seems to be reasserting itself: "How much agriculture must the country support?"

These are some of the matters with which Mr. Trow-Smith is concerned. Taking the Saxon invasion as a jumping-off point, his earlier chapters are non-controversial social and economic history, well told, if no more than retold. It is when he gets into modern times, describing the structure of farming from, say, the repeal of the Corn Laws onwards, that he is most instructive, on the one hand, as he fills the gaps in recent recorded history, and inclined to be controversial, on the other hand, as he interprets the consequences of national policy. Let it be said at once that he has escaped the pitfall of sentimental nostalgia for a rural society which probably never existed, but clearly he is seeking to establish standards of rural life and labour that will bring the material advantages, the amenities and the cultural life which town dwellers take for granted within reach of the well-paid agricultural mechanic of today. At the same time he is contriving to maintain the craftsmanship, the serenity and the beauty of country life, as so many of us like to imagine it, of bygone days.

Mr. Trow-Smith's book is alike readable and well written; it should appeal to a large public. A sad defect which must be noted is the absence of an index; chapter headings and analysed extensions of them in journalese—e.g., "Blue Prints for a New Agriculture"—"Hodge *resurgam*" [*sic*]—"Political Red Herrings"—etc.—are no substitute.

C.S.O.

Country Folk. NORMAN WYMER. Odhams. 15s.

After his recent explorations into rural topography and craftsmanship, Mr. Wymer turns his inquisitive pen to rustic life and character. Under his rather loose and possibly ambiguous title, he assembles a collection of careful, if uninspired, essays on a variety of ways of life up and down the land, on such differing folk as Cornish fishermen, Severn salmon trappers, Lakeland fell farmers, Dorset braiders, hop-growers, Wessex cider-makers, well-dressers, and those stalwarts, canal boatmen.

Mr. Wymer's tastes and inquiries are catholic, and his book is enjoyable without in any way being exciting or calculated either to inspire excitement for country living or to offer any reassurance that it is the good life for any of us. He never really reveals in so many words for whom his book is intended. For country folk themselves? Hardly, even if they settled to a book anyway. For townee settlers in the country? Possibly, but many of them know and see around them much of what is described. For the townsman forever dreaming of country peace and calm, then? Without a doubt; for this is yet another of those not unenjoyable "country" books for non-country readers, and within those obvious limits it makes interesting reading, especially when, as sometimes happens, some old character lights up a page. The sturdy Yorkshire dalesman, or the intriguingly confident water diviner, for example, or the stout fellows who make our malt for brewing. Farming comes off less fairly than one would have expected, however, and that still fairly significant, if dwindling, figure of the countryside, the gamekeeper, is inexplicably absent. But the main criticism of an instructive book is the romantic picture of the countryside which it draws. There is always a Constable sky or a Gainsborough reclining figure somewhere about: the pages have an impossibly Arcadian aura over them: little is said of mud and muck-heaps, crops that failed, rat-infested barns, poor housing, old crafts rotting away from within, bitterness, ignorance and stupidity. It is a common trap for country authors.

D.G.

Milk Pasteurization: Planning, Plant, Operation and Control. H. D. KAY, J. R. CUTTELL, H. S. HALL, A. T. R. MATTICK and A. ROWLANDS. Published jointly by the Food and Agriculture Organisation and the World Health Organisation. (F.A.O. Agricultural Studies No. 23 and W.H.O. Monograph Series No. 14.) 12s. 6d.

The safety of the public milk supply is of vital importance to agricultural and public health workers throughout the world. This monograph brings together essential information relating to the planning, design and operation of modern pasteurization plants, and the laboratory control of the process of pasteurization. The greater part of the volume is devoted to these aspects of the subject, which are dealt with in such detail as fully to justify the claim that the book contains "a comprehensive description of up-to-date equipment for pasteurization and a discussion of the problems encountered in the effective management and operation of such equipment". In addition, there are over ninety excellent illustrations, which enhance the value of the book.

Although space precludes more than a brief reference to raw milk in relation to pasteurization, it is made quite clear that the basis of a satisfactory pasteurized milk supply is raw milk produced on the farm in a clean and responsible way. It is emphasized that unless detailed attention is given to the essential requirements for the production of clean milk of good keeping quality, especially during the warmer part of the year, the milk may be completely unfit for processing. If there is still anyone who believes that the adoption of sound methods of production on the farm are unnecessary because pasteurization is a means of "cleaning up" dirty milk, this book should help to dispel this mistaken idea.

A perusal of the names of the experts who, with Prof. H. D. Kay, Director of the National Institute for Research in Dairying, have been responsible for this important work, is sufficient guarantee of its value to all workers in the field of dairy technology. To them, and to others who may be concerned in a non-technical capacity with the safety of the public milk supply, it will prove a mine of information. For those who wish to pursue particular aspects of the subject in more detail, there is a useful bibliography.

S.S.

General-purpose Farm Buildings. British Standard 2053: 1953. 2*s* 6*d*.

Concrete Hay Barns with Pitched Roofs. British Standard 2072: 1954. 2*s* 6*d*.

Two new British Standards, authorized by the Farm and Horticultural Buildings Industry Standards Committee, have recently been issued. The first of these relates to unspecialized single-storey buildings capable of adaptation to a wide variety of agricultural uses. It is based on the dimensions given in the Ministry of Agriculture's publication, *Farm Buildings* (Post-war Building Studies, No. 17), the spans being 17 feet 6 inches, 27 feet, or 32 feet 3 inches between uprights, truss centres being 15 feet apart and the height to the eaves 8, 10, 12 or 16 feet. The standard covers the various points of design and construction with the Institute's accustomed detail, clarity and efficiency, and there is a particularly interesting reference to certain points in the use of aluminium alloys, which are relative newcomers to the farmstead. Cross references are given to various other standards available for the completion of the building.

British Standard 2072 deals with the dimensions, design and materials of concrete hay barns, and includes references to other relevant British Standard specifications and to methods of protecting posts from accidental damage by lorries and tractors. It follows B.S. 1754 of 1953, entitled *All-steel Hay Barns with Curved Roofs.*

N.H.

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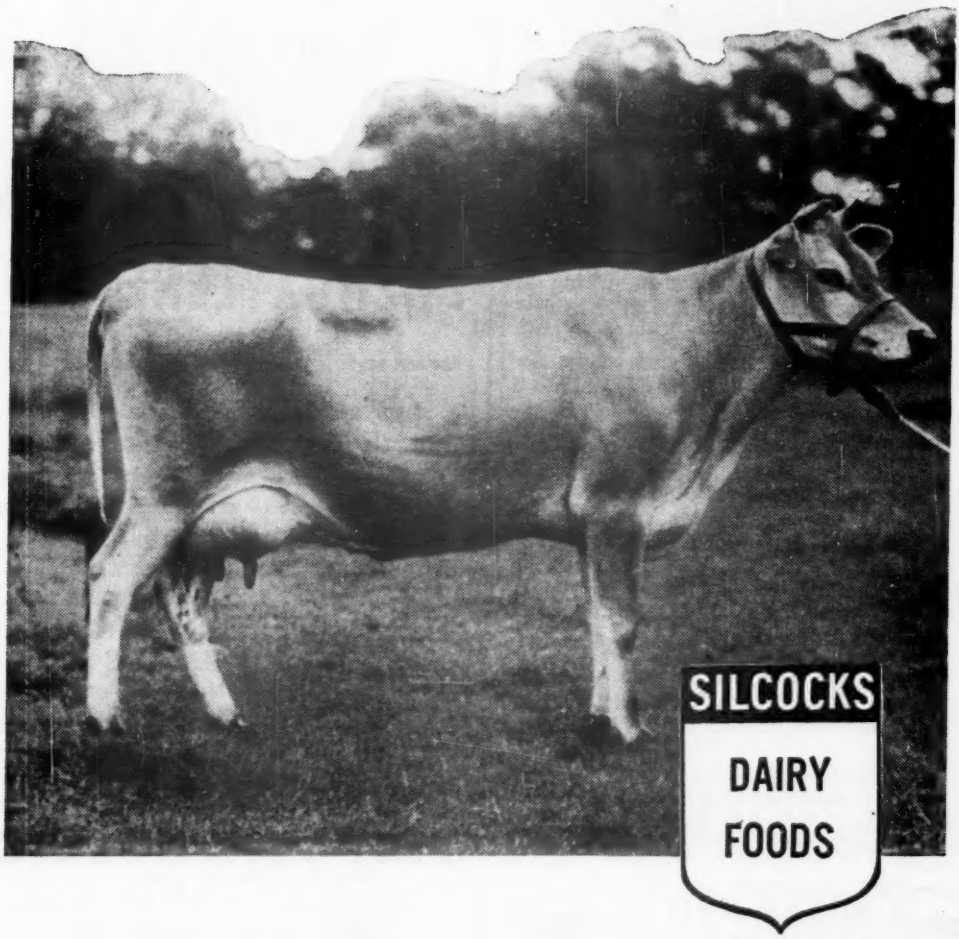

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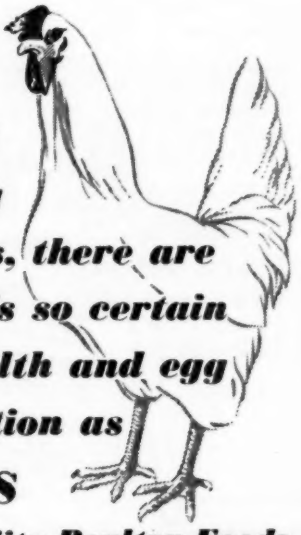

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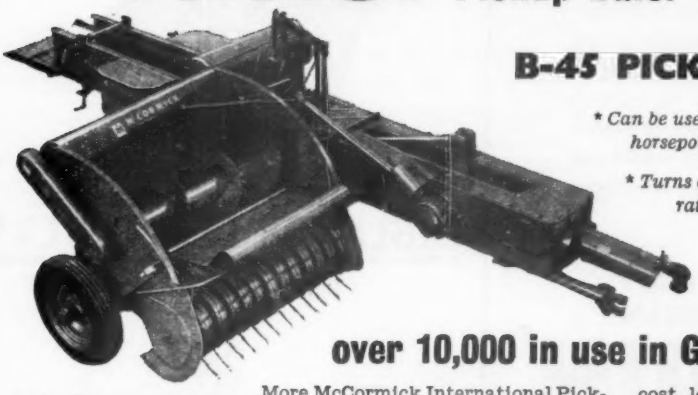

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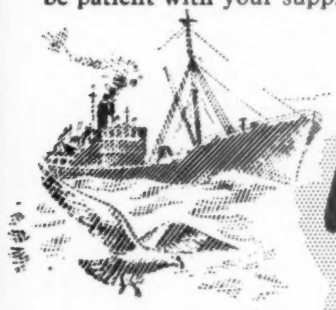

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I.C.I. FERTILIZER AND MANAGEMENT NOTES

The Weather

March should be a windy month. March dust is golden. Each fog in March means a frost in May—at least, so the old country proverbs tell us.

A dry March means a good lambing time. But rain is not wanted. The lambs get chilled.

Early Grass

There is often a nice natural growth of grass now. If young stock have an hour or so in the sunshine, they will straighten their backs, stretch their legs, and the grass will loosen their bowels.

Cereals

The top-dressing of cereals—with at least 2 cwt. per acre of Sulphate of Ammonia—should be tackled seriously.

Combine drilling—seed and fertilizer (2-3 cwt. per acre I.C.I. No. 1) together—has set a new standard in crop yields—especially when the seed is also dressed with 'Mergamma' to control fungi and wireworm.

Spring-sown cereals should receive a top-dressing of nitrogen—2 cwt. of Sulphate of Ammonia or 3 cwt. of 'Nitro-Chalk'—in May, if they are to yield their maximum. So modern, short, stiff-strawed varieties should be sown.

Co-operation between plant breeders and the fertilizer experimentalist has increased the average yield of cereals throughout the country more in the last ten years than in the whole of the preceding century.

Grassland

During March, the "early bite" fields in the Midlands and North will be receiving their nitrogen top-dressing (3 cwt. of Sulphate of Ammonia or 4 cwt. of 'Nitro-Chalk' per acre), while in the South those fields that are to be cut for silage, hay or dried grass will be dressed with similar amounts to make sure of the maximum weight per acre.

Nitrogen gives more grain per acre -and a better sample

TAKE BARLEY for instance. A recent survey* of 23 farms involving 1,686 acres of barley shows that high yields, high profits and high use of fertilizers all go together.

From the figures of this survey where the expenditure on fertilizers was £3.18.0. per acre, the yield averaged 28.3 cwt. and the profit was £23.0.0. per acre.

Where the fertilizers applied cost only £2.2.0. per acre the profit dropped to only £1.2.0. per acre, the average yield being below 15 cwt. per acre.

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**Agricultural Economics Dept., Reading University.*

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